MACHINERY

NOVEMBER 15, 1961 ONE SHILLING & THREEPENCE

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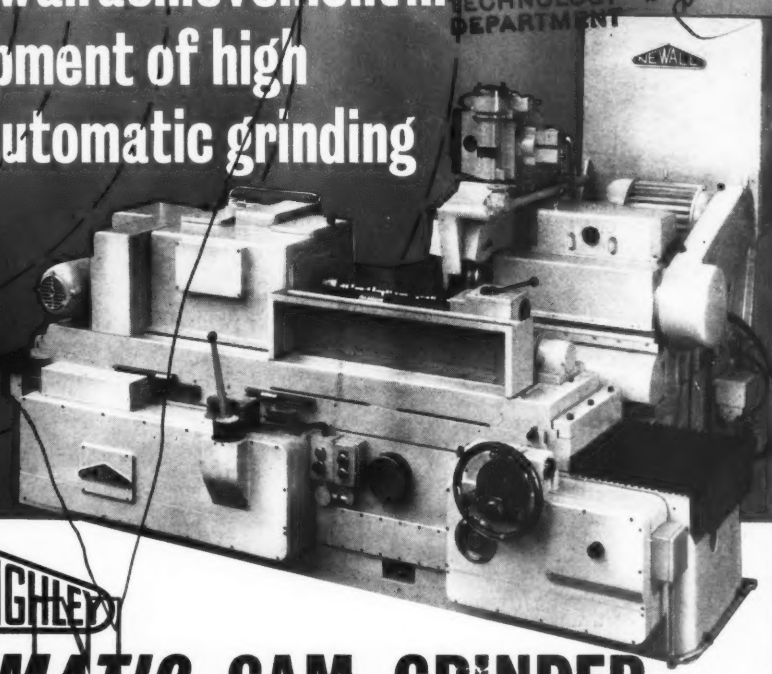
TECHNOLOGY DEPARTMENT

another Newall achievement in the development of high precision automatic grinding machines.



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AUTOCAMATIC CAM GRINDER

FEATURES Fully automatic cycle for cam lobe grinding includes wheel dressing and compensation for truing. Quick change cam bank. Exceptionally rapid and shock-free table indexing. Optimum accuracy of cam form and surface finish automatically achieved. Automatic reduction of work speed for spark-out. Grinds cams tapered in either direction on one shaft. Stock removal variable to user requirement. Built throughout to J.I.C. standards. Size range: 5″ swing 20″, 30″ or 50″ length capacity.

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Automatic Drilling Machine for Condenser Tube Plates

This machine offers a modern approach to the problem of drilling and tapping the thousands of holes in condenser tube plates. It employs a 3-spindle mutlti-head and is tape controlled by 2-dimensional positioning equipment. High accuracy is ensured by leadscrews and nuts of the "Beaver" ball recirculating type applied to the indexing of the table and drilling head. The table of the machine illustrated is 10ft. wide × 14ft. 6in. long and traverse of the unit head on the crossrail is 10ft. 6in. Stroke of the table is 14ft.

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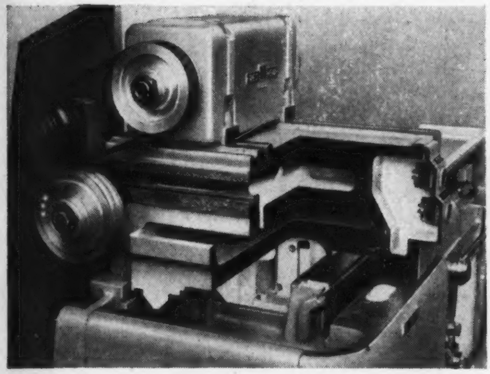

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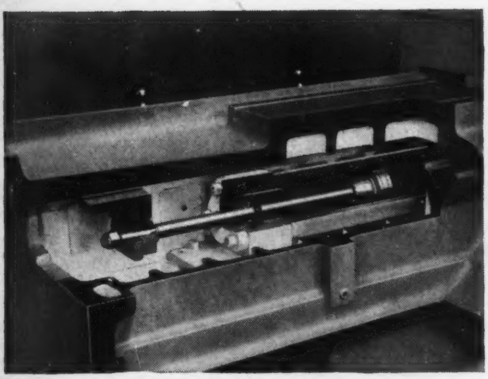
by dissipation of heat through cored passages whilst retaining heavily ribbed construction for work and fixture support.



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through positive table travel provided by special, distortion-free cylinder and piston mountings

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precision boring-head construction
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isolated hydraulic power unit.

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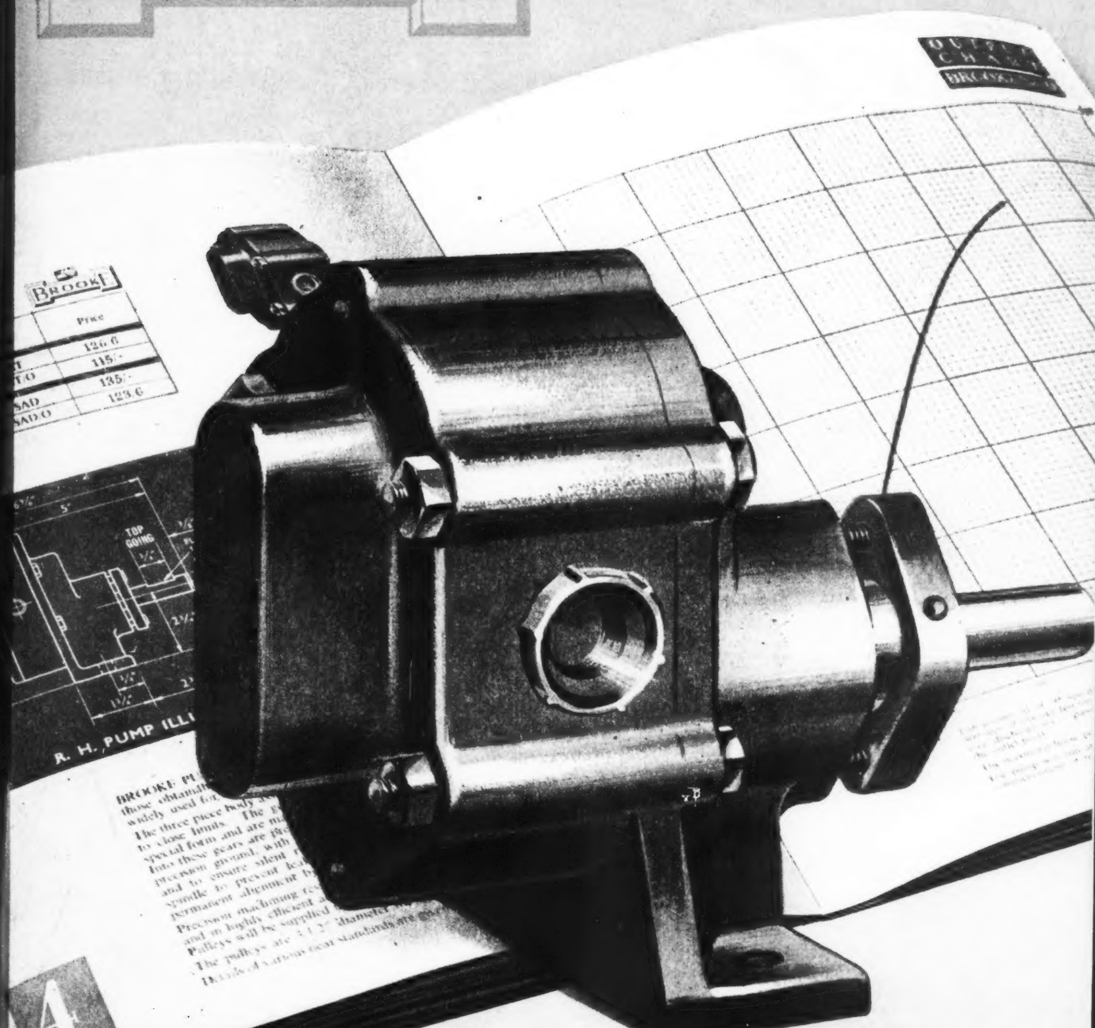

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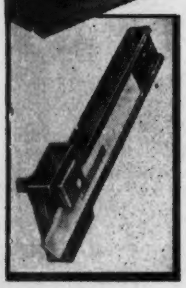



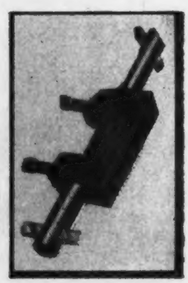

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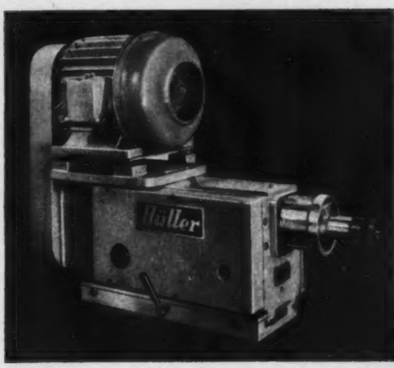
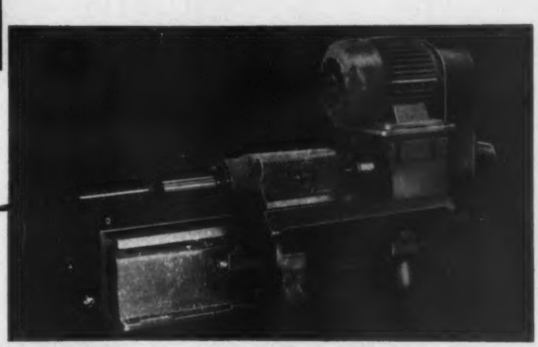


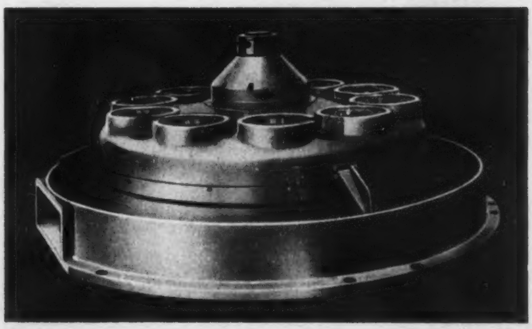
Mechanical drilling unit type ME 3

Drilling capacity in steel max. 1" dia. spindle stroke max. 2·75", cam-operated feed.

Hydraulic deephole drilling unit type BTH

For drilling deep holes, i.e. oilways in crankshafts, conn rods, valves, etc. Drilling depth up to 14·80"





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In nine sizes, from 13·80" to 70·80" dia. Dividing accuracy ·0004" to ·0012" per division according to table size.

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In six different sizes, without feed mechanism, for mounting on to hydraulic slide unit SEH or stationary.
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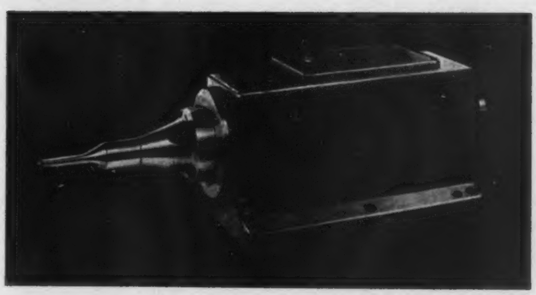

Bishop, Eaves & Sons, Ltd.

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Telephone: East 4871

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A panoramic illustration of

A typical pressing assembly of body panels and other components as produced on Wilkins & Mitchell Presses

WILKINS & MITCHELL PRESSES at PRESSED STEEL Co. Ltd., LINWOOD

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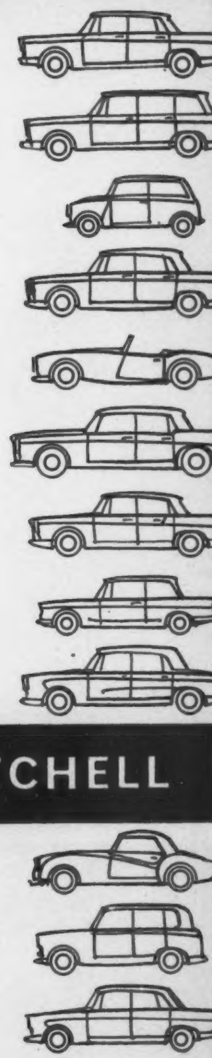

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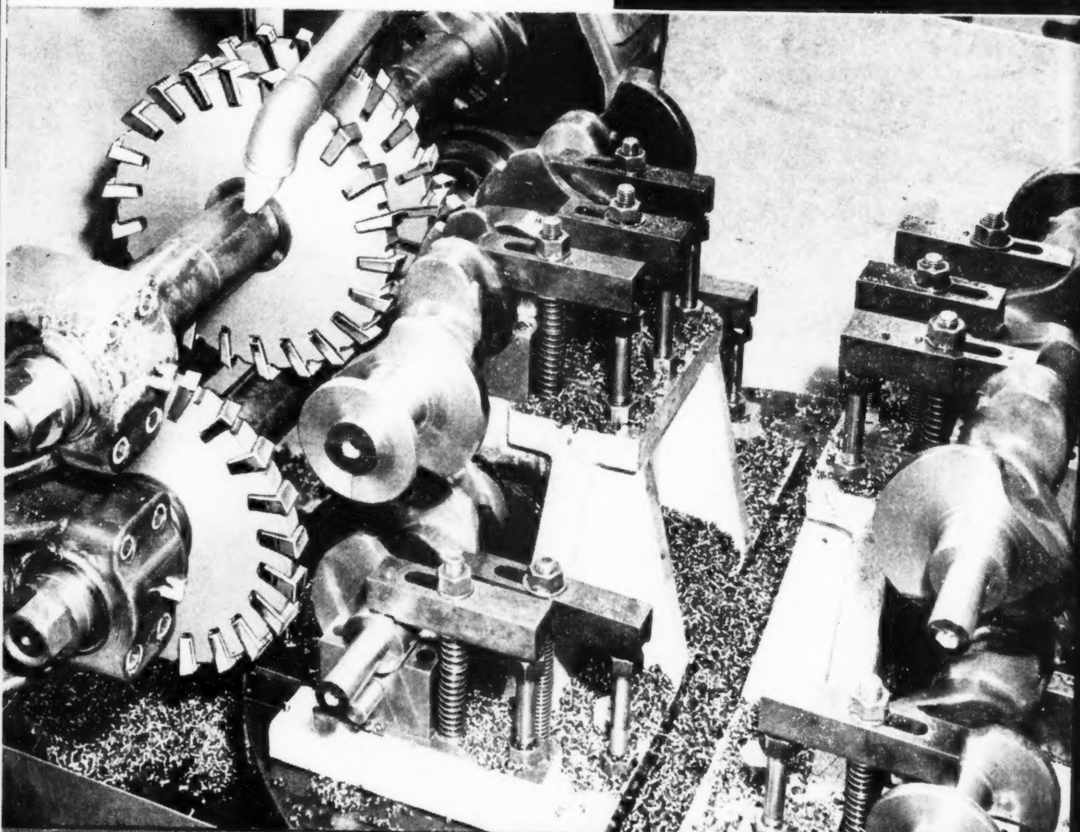
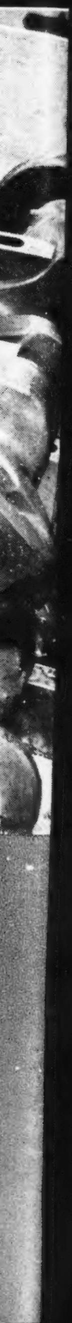


ON CRANKSHAFT PRODUCTION

The illustration above shows a gang of "GALTONA" half side cutters, 12" diameter in operation, milling the clearance for pin turning on six-cylinder crankshafts. At Morris Motors Limited, as in engineering shops all over the country, "GALTONA" serrated blade cutters have proved their ability to reduce costs.



SERRATED BLADE CUTTERS AND GROUND THREAD TAPS

PPING CYLINDER HEADS

On Type "C" cylinder heads, 15 holes ranging from $\frac{1}{8}$" UNF to 1$\frac{1}{8}$" B.S.P., are tapped using "GALTONA" ground thread taps. The operations are carried out on a special transfer machine, and on work of this kind the uniformly high quality of "GALTONA" taps ensures a continuous production flow.

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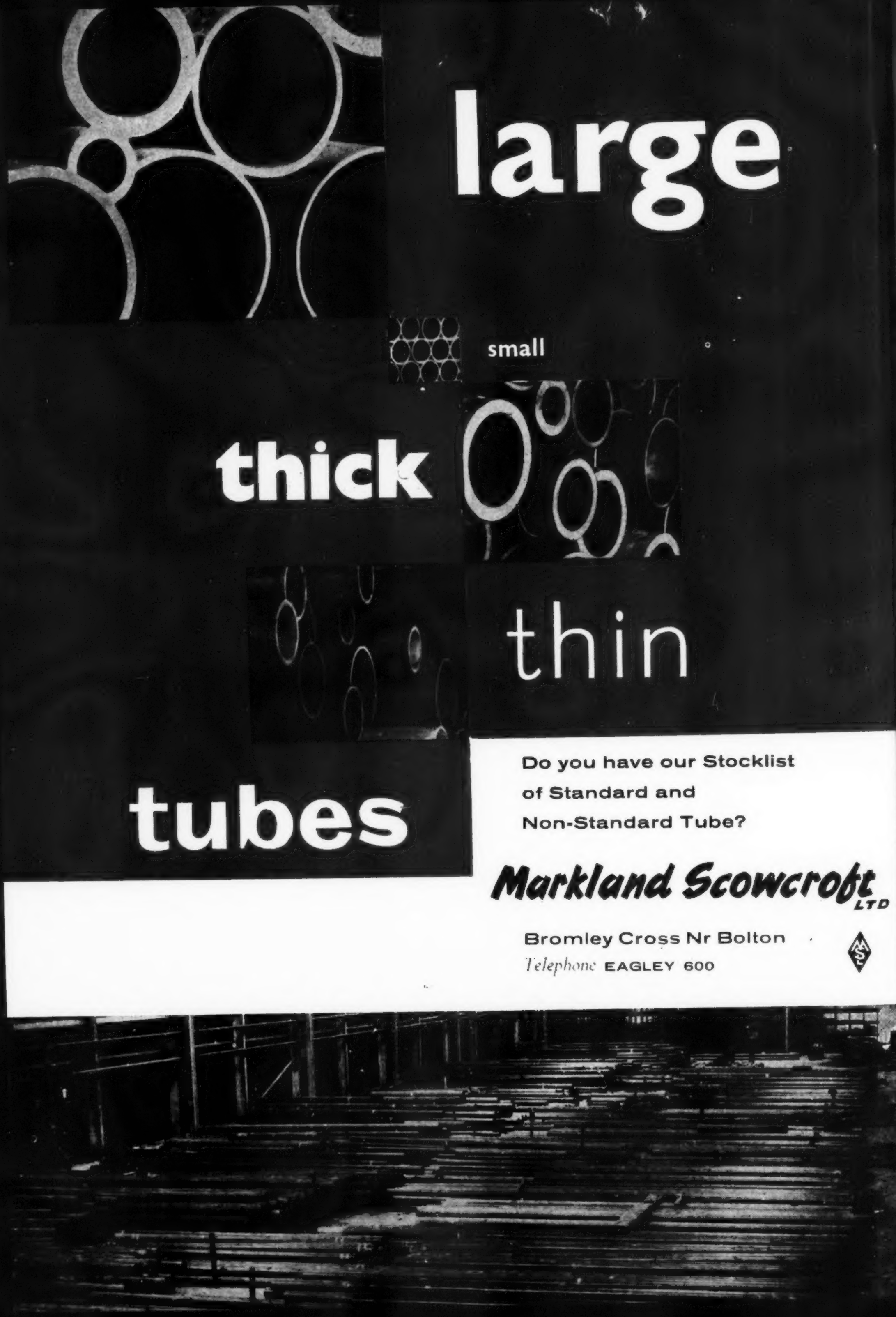
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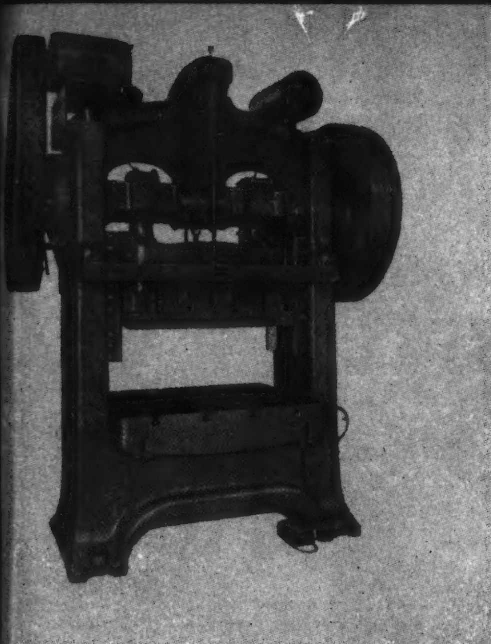

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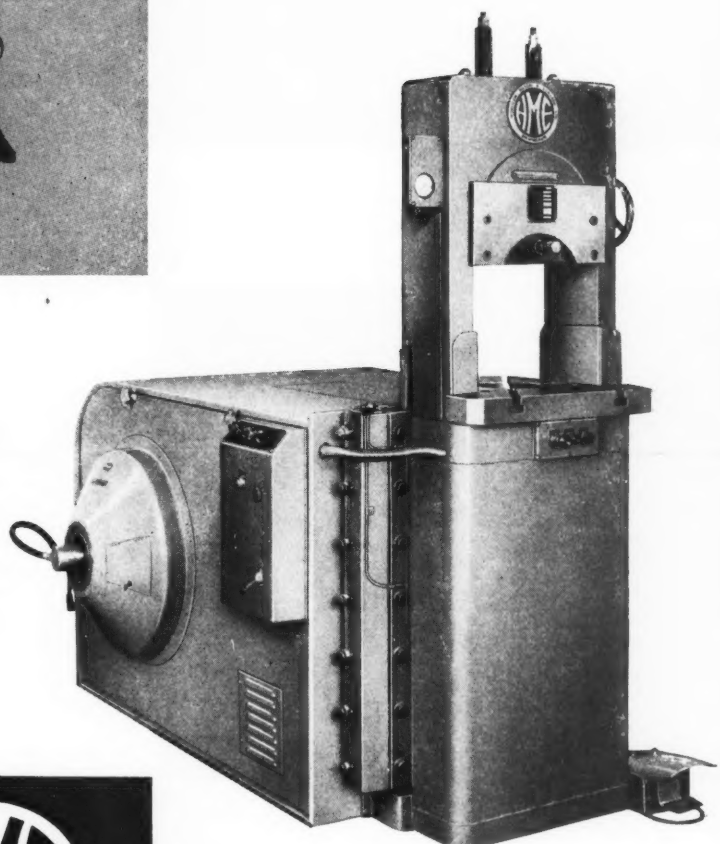

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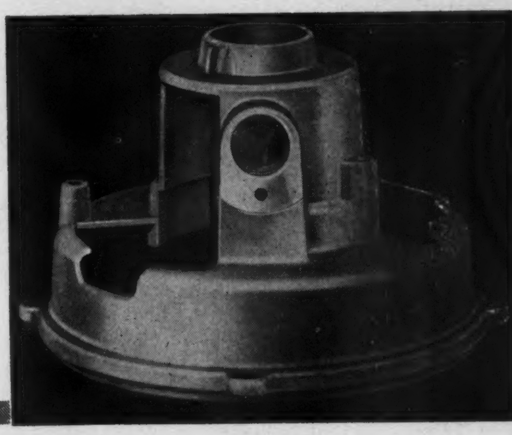
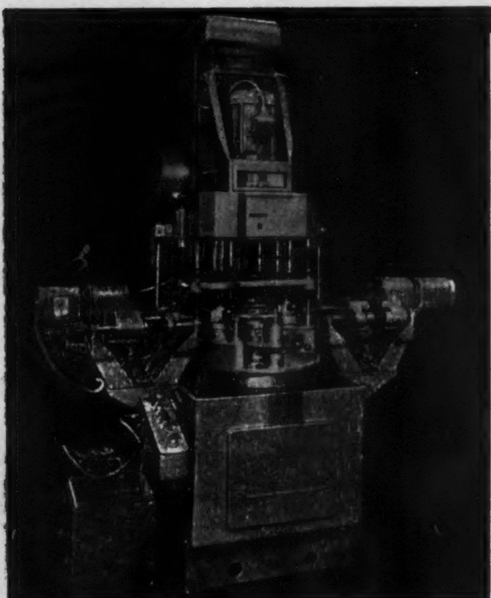


Working with the MULHEAD Mk IV ROTARY AUTOMATIC



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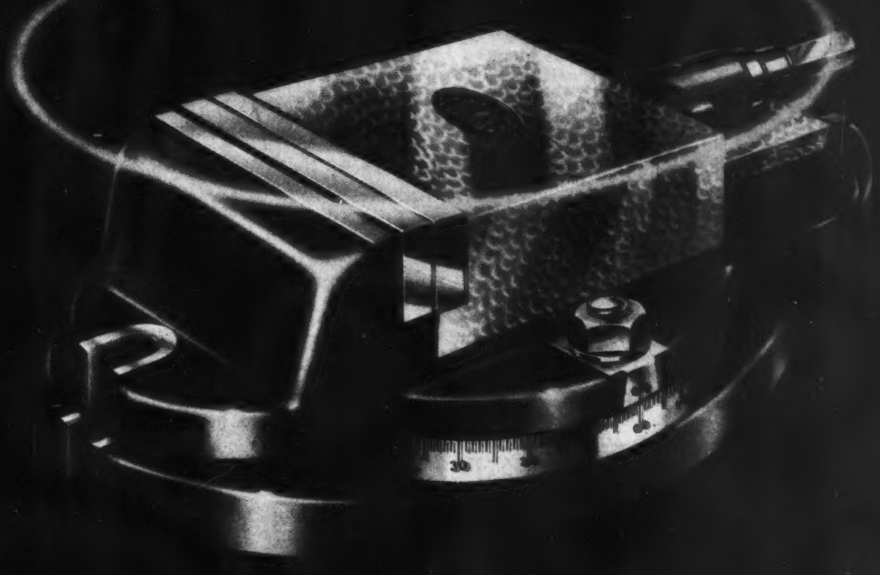

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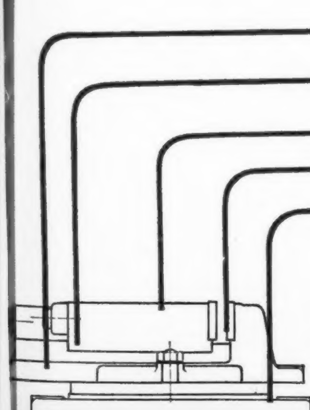

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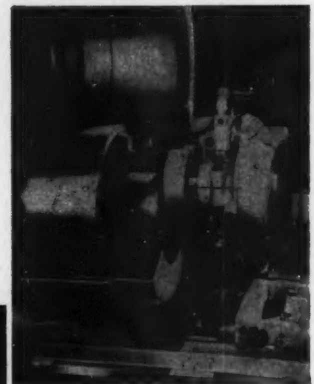

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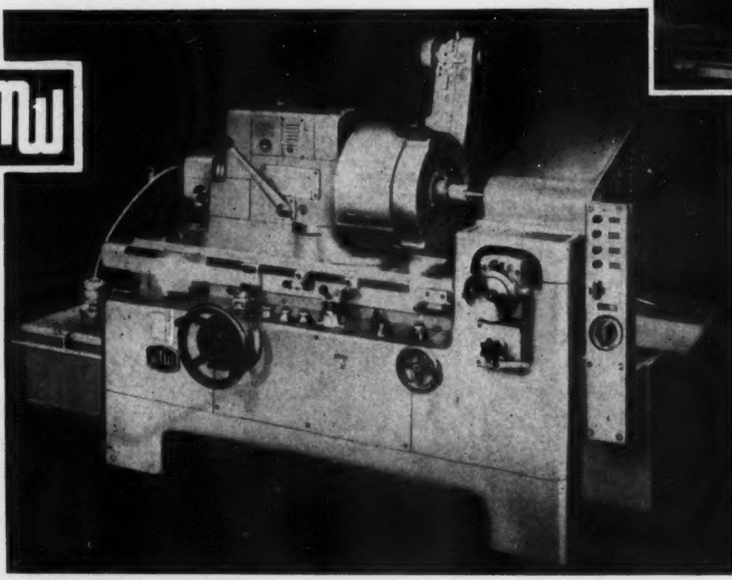

The face grinding attachment

Should there be faces to be ground, the direction of which is to be parallel to the bores, the face grinding attachment is needed which is hydraulically swivelling by hand control whereby the grinding spindle drive is engaged automatically.

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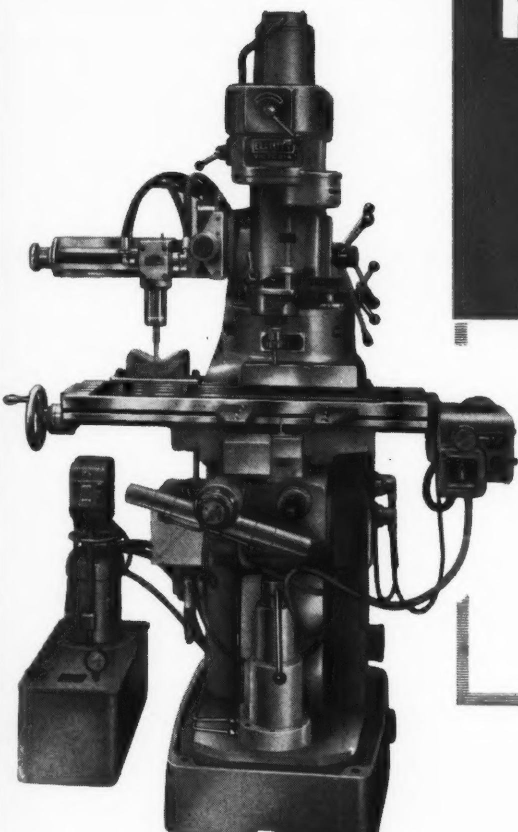

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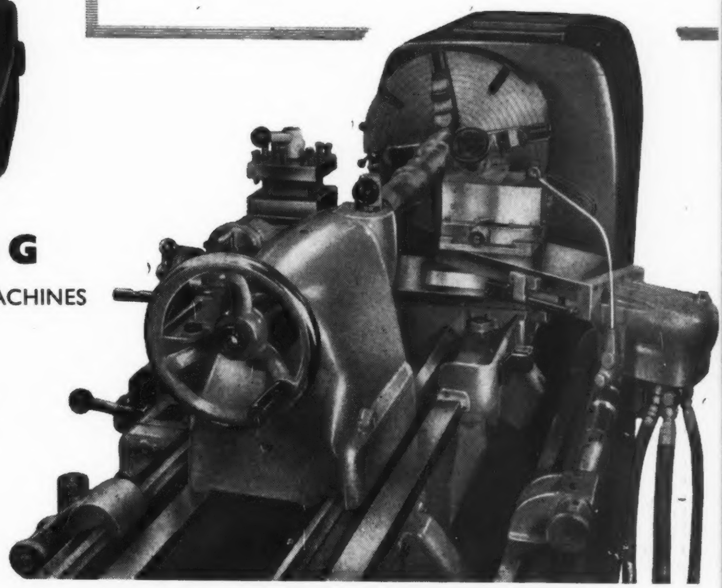

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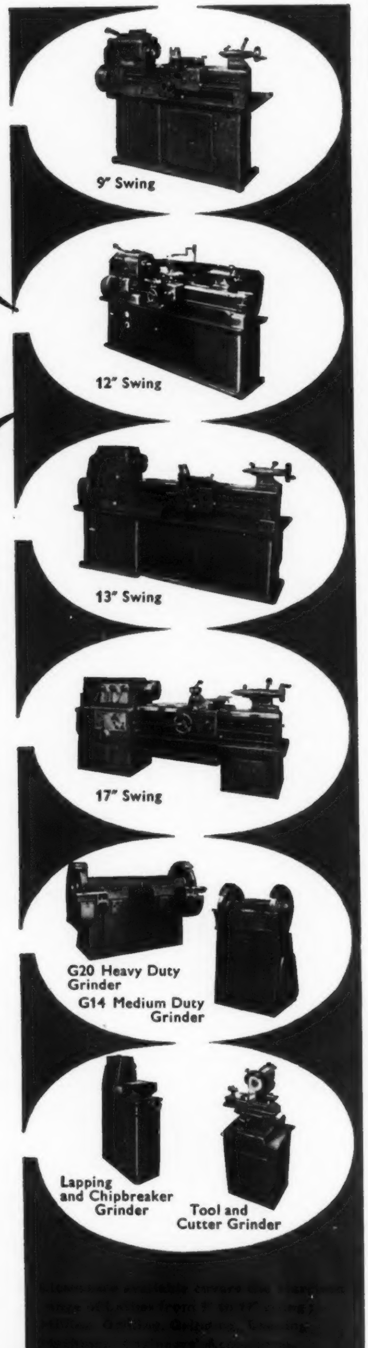

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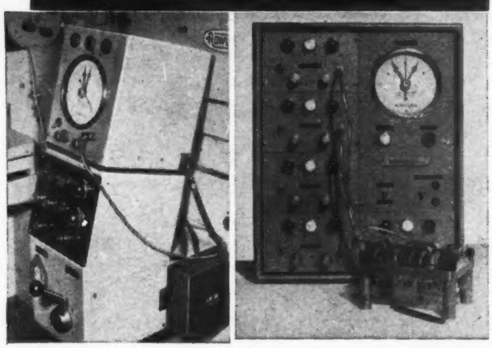

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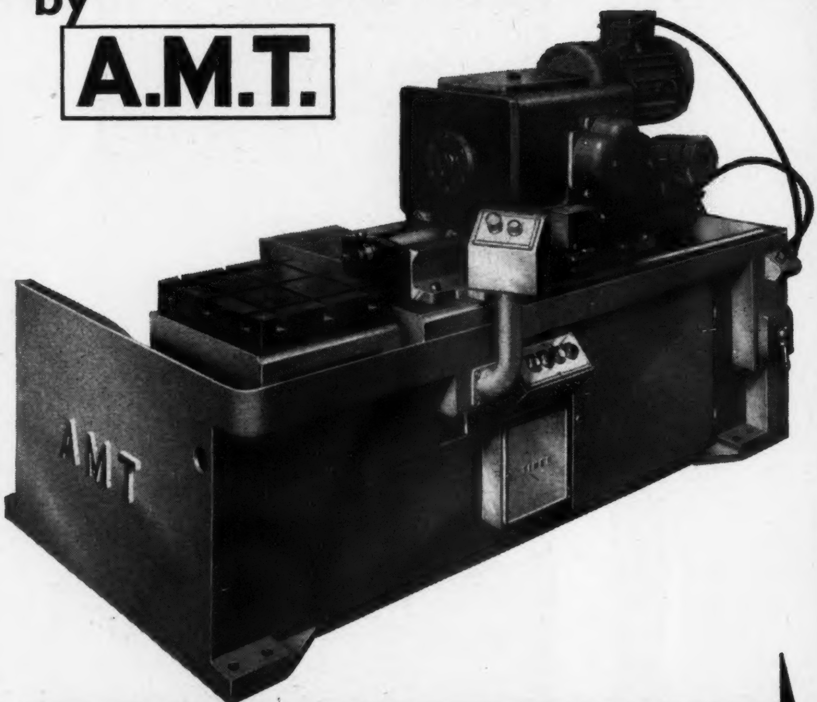

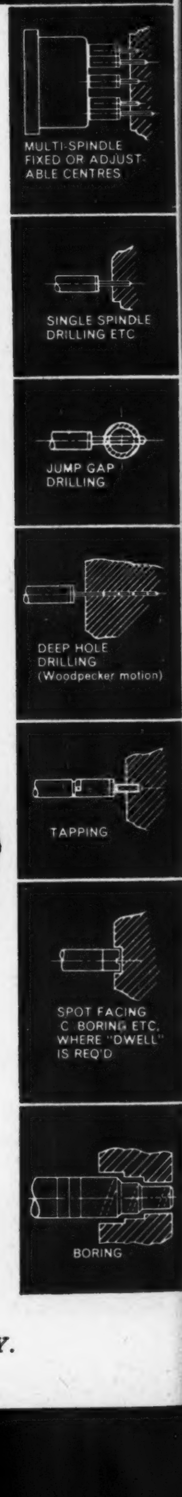

with BUILT-IN SELECTION FOR ALL THESE CYCLES brings AUTOMATION for small or quantity production at unusually low cost

Here is a "multi-cycle" machine within the price range of a single-operation production machine which has been developed especially for batch or quantity production. It is available in three sizes—2 h.p., 5 h.p. and 10 h.p. for horizontal or vertical application.

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10/13 COMBINATION TURRET LATHE

having Hydraulic Actuation of Driving Clutch giving finger-tip Gear Change.

29in swing over bed covers

'PRELECTOR' Combination Turret Lathes with Preselective speed-changing.

TURRET LATHES with capacities up to 35 in. swing over bed

1½ in. to 2½ in. 'D-S' DOUBLE-SLIDE Capstan Lathes for heavier accurate work.

Stock Tools, Toolholders, Chucks and Accessories for Capstan and Turret Lathes.

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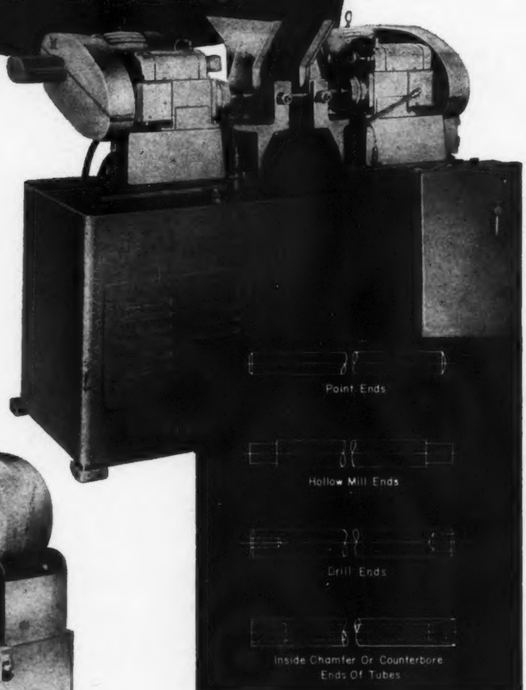
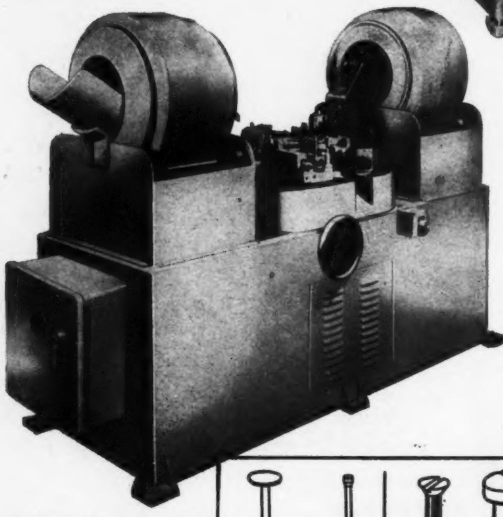


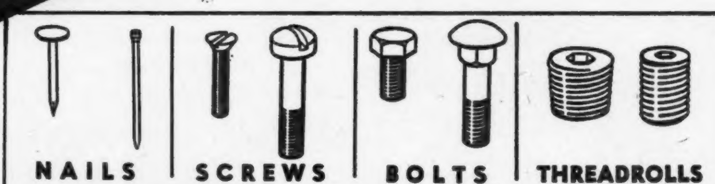
These versatile, fully automatic, low-cost machines handle, at high speed, an almost unlimited variety of work—pointing, facing, turning, shaving and thread rolling—on nails, bolts, screws, rods, bushes and similar parts in a wide range of sizes.

Write for literature giving details of our wide range of **SECOND OPERATION MACHINES** for **pointing, chamfering, shaving, necking, facing, grooving, end drilling** and **thread rolling.**

DOUBLE END AUTOMATIC POINTING MACHINE for pointing, hollowing-milling and drilling operations on studs and rods ¼" to 1½" diameter.



PLANETARY THREAD ROLLING MACHINE for thread rolling, roll forming, knurling, necking and serrating of bolts, screws, etc.



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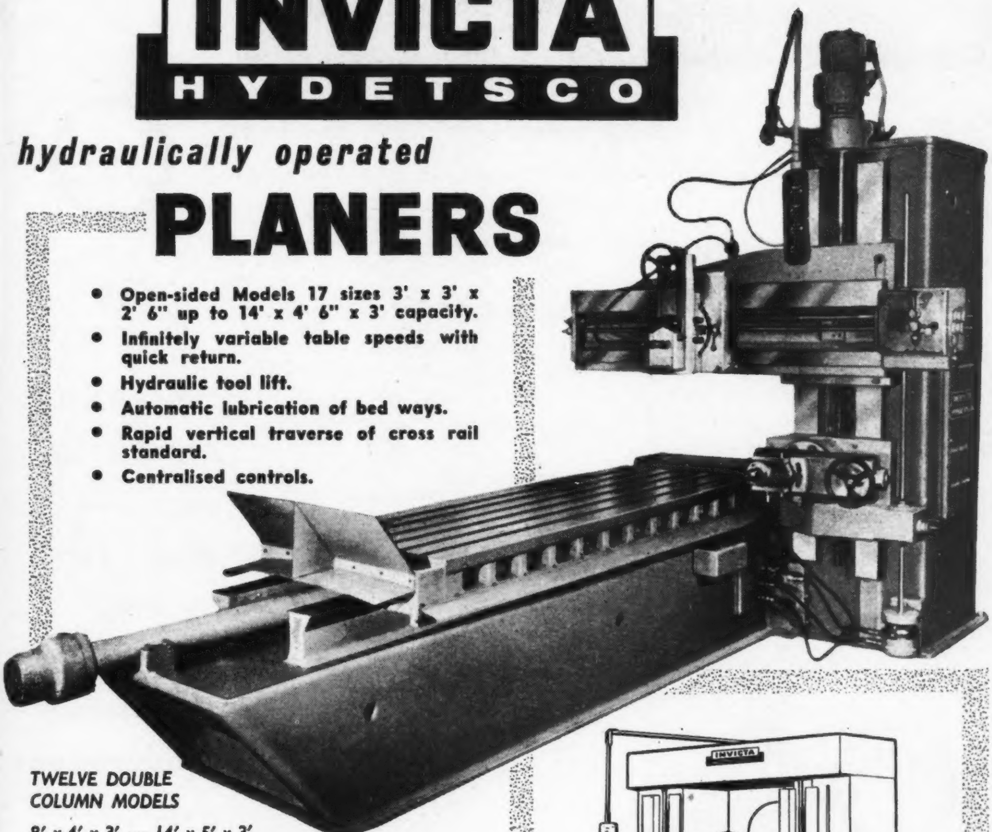
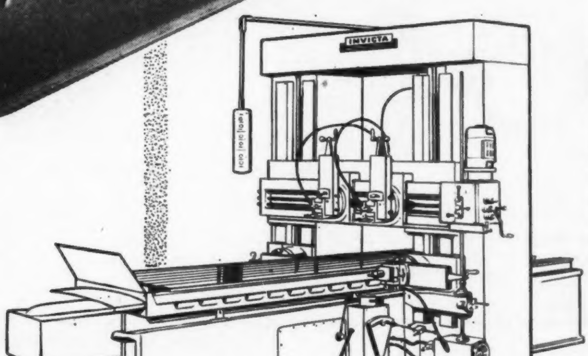
PLANERS



- **Open-sided Models 17 sizes 3' x 3' x 2' 6" up to 14' x 4' 6" x 3' capacity.**
- **Infinitely variable table speeds with quick return.**
- **Hydraulic tool lift.**
- **Automatic lubrication of bed ways.**
- **Rapid vertical traverse of cross rail standard.**
- **Centralised controls.**

TWELVE DOUBLE COLUMN MODELS

8' x 4' x 3' — 14' x 5' x 3'



Additional tool head on cross rail. Milling heads. Grinding heads. Rapid cross traverse of heads. Outer support for cross rail. Concertina guards for all ways are available to order.

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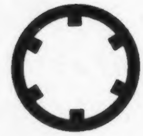
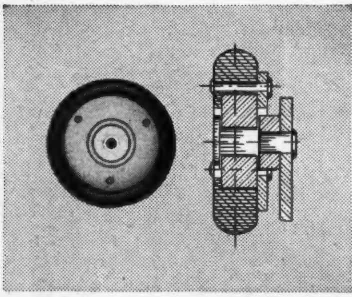
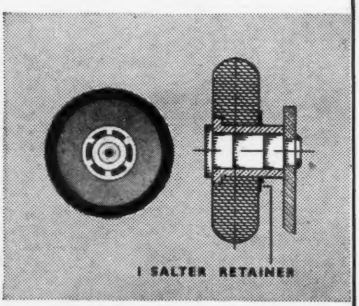
How costs are cut with SALTER RETAINERS

Salter retainers simplify design of overhead door wheel with great savings





THE OLD WAY Overhead door wheel flushing held in wheel by three rivets. Difficult to position rivet holes and many rejects. Rivets would work loose in use.



THE SALTER WAY A Salter Self-locking Retainer which requires no groove, replaces three rivets, a spacer and three press operations. Cuts cost and manufacturing time and gives a better and cheaper product.

ELIMINATES

drilling 3 rivet holes	·18
riveting washer	·5
punching washer	·02
washer, spacer, rivets	·95

CUTS COST OF

inserting bushing	·01
inspection	·14
wheel, bushing, rivet	3·45
TOTAL SAVING WITH SALTER RETAINERS	5·25d

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1 SALTER RETAINER cuts unit cost by 44% and eliminates 3 operations and 5 parts

NEATER – MORE POSITIVE – PERMANENT RETAINING

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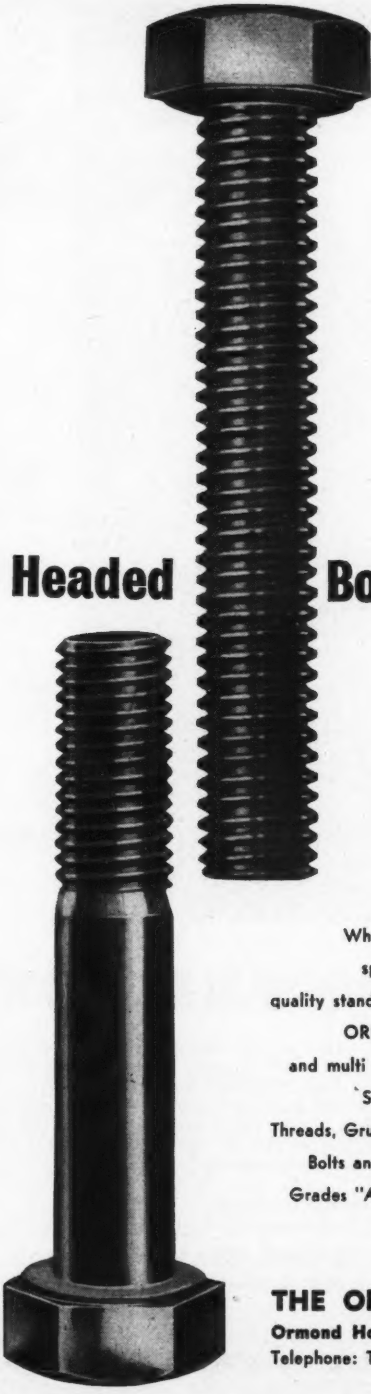
Circlips *Fasteners* *Retainers* *Fixes*

Geo. Salter & Co. Ltd., West Bromwich. Spring Specialists since 1760

M-W. 483

Cold Headed Bolts and Set Screws



Why look elsewhere, when all the benefits of long specialization plus the closest adherence to exacting quality standards are so conveniently available. Let ORMOND quote for all Repetition Parts—for single and multi spindle automatics up to $1\frac{1}{4}$" diameter; Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grub screws, Nuts, Allthreads, Hexagon Bolts and Set screws turned from bar and Cold Headed Grades "A", "B" and High Tensile.

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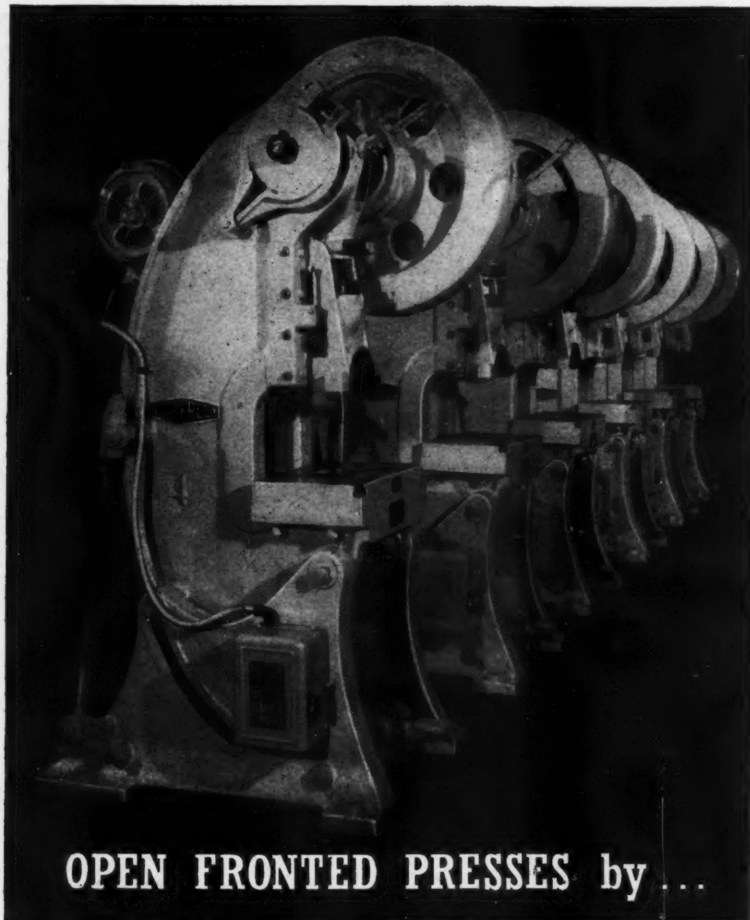

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All castings are made by the MEEHANITE process in our own well-equipped foundries. The Butterley foundries are available for the production of high-grade MEEHANITE castings to customers' requirements.

We invite your enquiries for MEEHANITE castings of all grades up to 20 tons.

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MATRIX QUALITY THREAD GRINDERS give you toolroom precision plus production line speed. Traverse grind as fine as 20 BA or leads as coarse as 12" Plunge grind threads 3" long in a turn and a half Wheels formed by multi-rib or single-rib diamond dressers or manual or automatic crushing units.

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Automatic dividing attachments, circular tables and clamping fixtures can be included in the programme which can contain an infinite number of stages.

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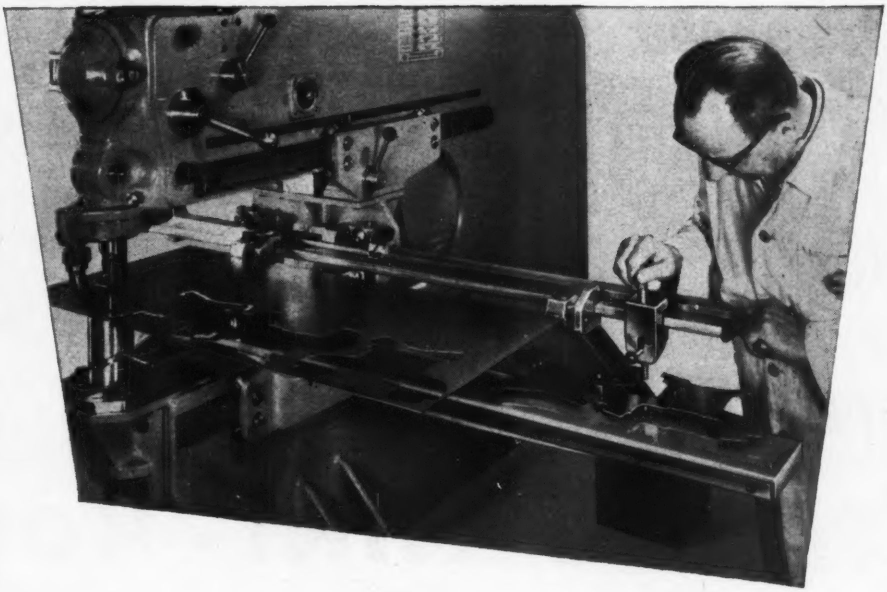
COPY-NIBBLE

all the blanks you can't stamp out



MANY blanking or punching jobs are too costly for press and tools: area too big or too few off, so the ideal method is copy-nibbling to cut internal and external shapes with no extra tools: each one a facsimile of the last — from one master shape. Circular blanks and circular or rectangular cut-outs require no master: just make use of the ingenious system of movement and co-ordinate scales incorporated in the machines. Three Trumpf models to cut up to 0.16in. thick (32 tons tensile) and up to 23½in. diameter.

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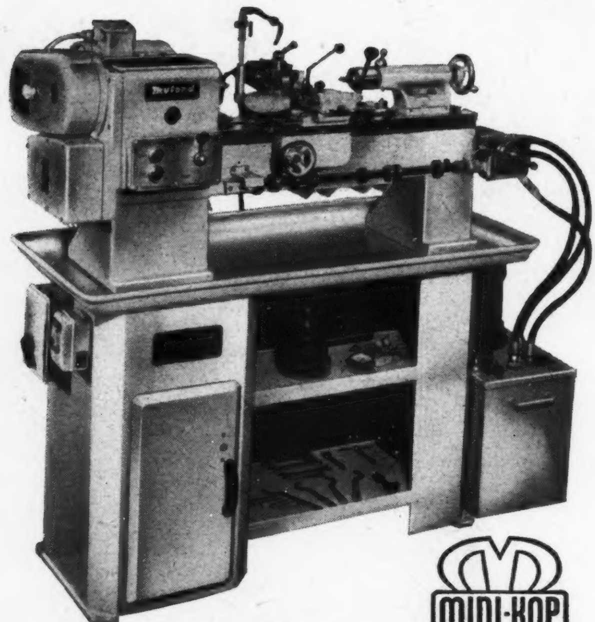
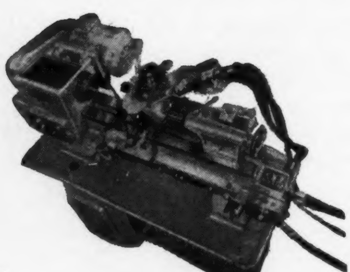


a high-speed hydraulic copying lathe for small parts

MINI-KOP

Myford MINI-KOP

SERIES 1A



Specifically designed for copy-turning small components up to 1 inch diameter. This is a fully hydraulic machine with hardened bed . . . hydraulic carriage motion has instantly variable feed-rate control and fast traverse in either direction . . . alternative reproducer approach angles . . . and many other features to facilitate small component copying.

Automatic length stops accurate within 0.001 inch.
Will reproduce steps as small as 0.0005 inch.
Will reproduce profiles within 0.001 inch on the diameter.
Will repeat diameters well within 0.001 inch.
Spindle speeds to over 4,000 r.p.m.
Costs little more than many copying attachments.

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Your Auto is NOT Fully Automatic without

LIPE
BAR FEED

Here's Why...

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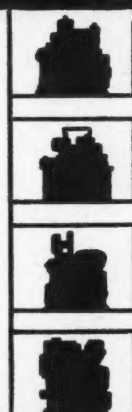
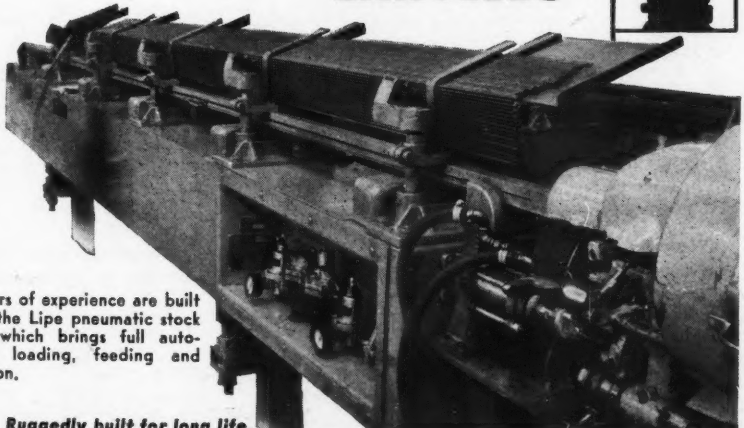
B **Machine runs continuously—no time wasted.**
C **Absolutely reliable — one operator can handle several machines.**
D **30% to 100% production increase.**
E **No feed fingers—feeds to LAST workpiece and ejects remnant automatically.**
F **Patented Rear Ejection gives positive control of remnant at all times, increases versatility of Bar Feed.**



THERE'S A LIPE FOR MOST BAR FED MACHINES

LIPE *FULLY AUTOMATIC PNEUMATIC* **BAR FEEDS**



Years of experience are built in to the Lipe pneumatic stock feed which brings full automatic loading, feeding and ejection.

Ruggedly built for long life, simple to install, set and service.
Models cover range from $\frac{1}{16}$in. to $1\frac{1}{4}$in. bar and $\frac{1}{8}$in. to $1\frac{1}{2}$in. tube.

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NRP 2332

"What is it that you like most about REISHAUER?"

"Two things—remarkably high production and simplicity of setting and control."

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"We did at first but found it was entirely our own fault through using the wrong types of grinding wheel."

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"No trouble on the REISHAUER—as a matter of fact we've ground master gears on the machine."

"You are gear grinding specialists and have added a REISHAUER ZA to a shop already filled with gear grinders. What then would be your advice to a firm who have not a single gear grinder and are wondering which would be the best choice to make?"

"You just couldn't better the REISHAUER. It is so universal and look at the high helix angle (45°) it will accommodate!"

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"On the contrary—the required amount is put on the cam or template in the dressing device and it stays put until the job's done."

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"We have in fact had this trouble but it was remedied by employing a compensated wheel form."

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GEAR GRINDERS
FOR SPUR & HELICAL GEARS
NZA for gears ¾" to 11¾" diameter, 5 DP.
ZB for gears up to 27½" diameter, 3½ DP.

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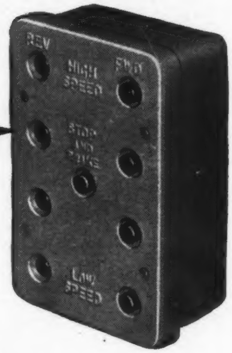
NOW- Finger-Tip Control for Seated Operation

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5/8" or 13/16" bar capacity

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SECOND OPERATION LATHES

With the controls at her finger-tips the operator performs the simple necessary motions much more rapidly, saving time on each component. Seated comfortably, she experiences little or no fatigue. Resting time is reduced and the flow of work is more constant and rapid. The basic machine can be used either for bar or second operation work and from the extensive equipment available can be selected just the right items for your needs.

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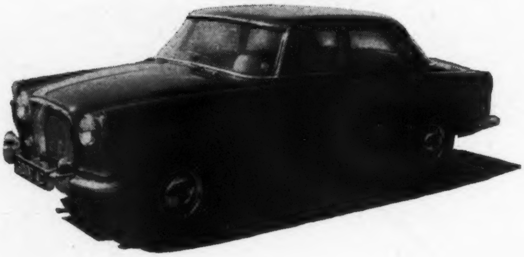
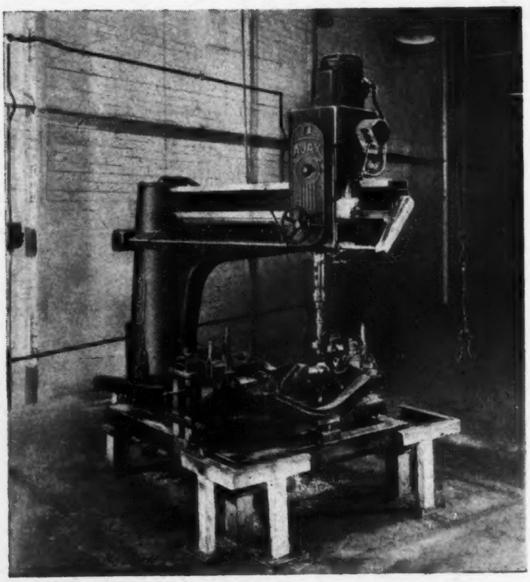
AJAX AJ31 RADIAL

for Rover 3 litre car production



It is significant that the Rover Co. Ltd., one of the manufacturers of Britain's finest cars, has chosen AJAX AJ31 Drills to assist in the production of their superb 3 litre car. They are used for jig drilling and spot facing engine sub-frames, apart from many other machining operations — once again AJAX RELIABILITY — predominates.



Photographs courtesy of The Rover Co. Ltd., Solihull, Birmingham.

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* 6', 7' or 8' arm
* Spindle No. 5 M.T.
* 8 spindle speeds
* Choice of 3 speed ranges

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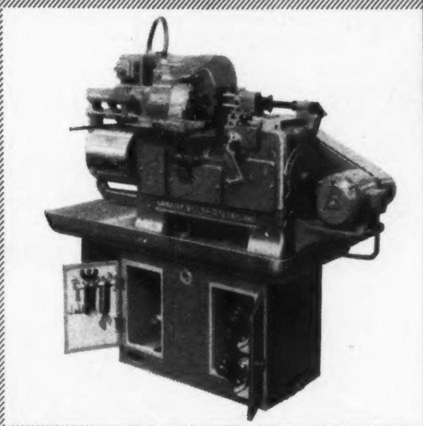

TYPE 904

CAPACITY

Round Bars. Dia.	7/8"
Hexagon Bars. A/F ...	0·71"
Square Bars. A/F	9/16"
Maximum Travel of Tailslide ...	2"
Maximum Travel of cross slide ...	1 5/16"

SPINDLE SPEEDS

Speed Range ...	810-2,500 r.p.m.
No. of Speeds	14

TYPE 907

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Round Bars. Dia.	1¼"
Hexagon Bars. A/F	1·01"
Square Bars. A/F	7/8"
Maximum Travel of Tailslide ...	2½"
Maximum Travel of cross slide ...	1 3/8"

SPINDLE SPEEDS

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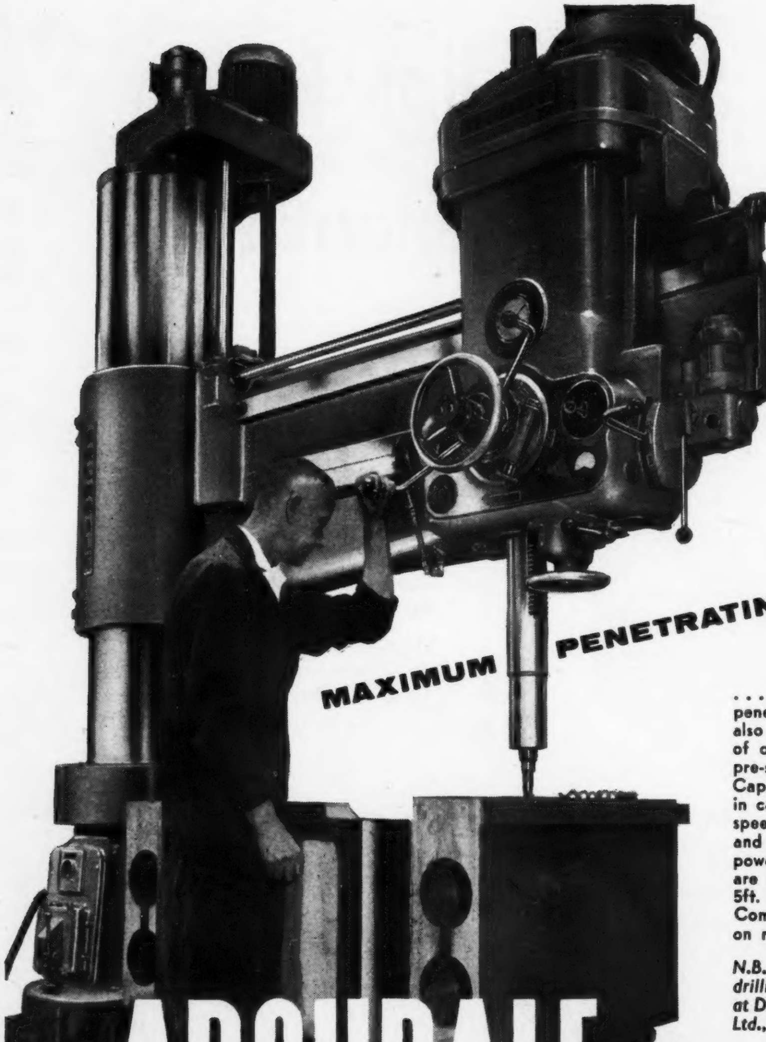

. . . and not only maximum penetrating capacity . . . but also unsurpassed speed and ease of operation, due to hydraulic pre-selection of feeds and speeds. Capacity is up to 4½" diameter, in cast iron. There are 22 speeds from 11 to 1450 r.p.m., and 18 rates of feed. These powerful and versatile machines are available in ten sizes, from 5ft. to 14ft. spindle radius. Complete details gladly sent on request.

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TURBO MATIC

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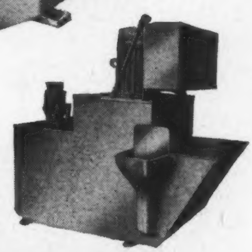

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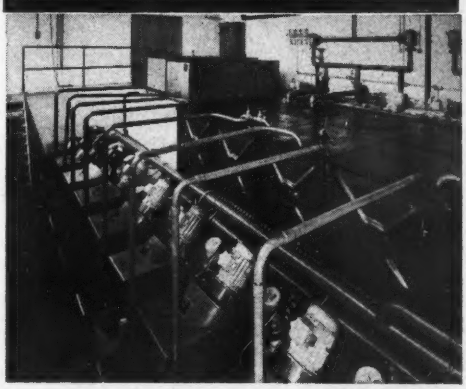

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Schneider

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IMMEDIATE DELIVERY FROM STOCK

MODEL JOH3

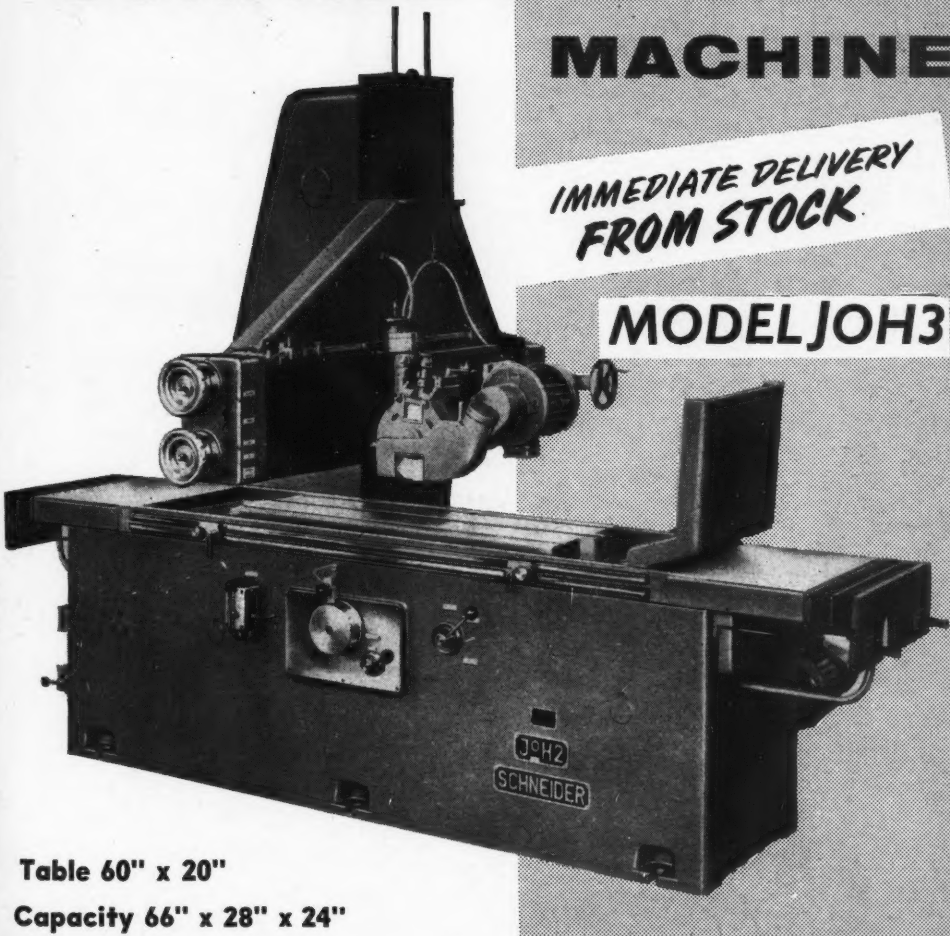

Table 60" x 20"

Capacity 66" x 28" x 24"

Please send for full details.

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NRP 3461

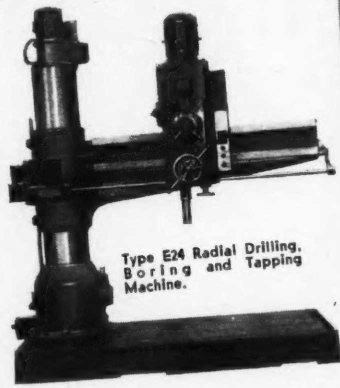
K&W For the Modern Machine Shop

ELEVATING ARM RADIAL DRILLING BORING AND TAPPING MACHINES

Kitchen & Wade Elevating Arm, Radial Drilling, Boring and Tapping Machines are modern in design and incorporate many up-to-date features, particular attention being paid to the grouping of controls for ease of operation.

Rigid and robust in construction, accurate and reliable, these radials are meeting the exacting production demands of industry to-day.

Listed below are types available with drilling capacities up to 3½" in steel and maximum radius of 10ft.



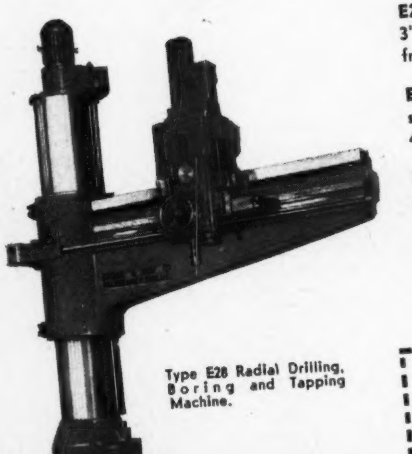
Type E24 Radial Drilling, Boring and Tapping Machine.

E25 The lightest model in the range, made in 3 sizes, 3' 0", 3' 6", 4' 0" max. spindle radius. Capacity 1½" dia. from the solid in mild steel.

E26 This machine has a capacity of 2" dia. from the solid in mild steel and is made in 5 sizes 3' 0", 3' 6", 4' 0", 4' 6", 5' 0" max. spindle radius.

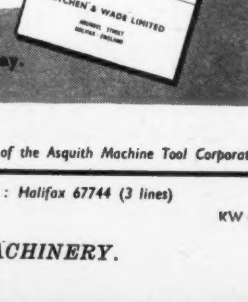
E24 Made in 4 sizes 4' 0", 4' 6", 5' 0" and 6' 0" max. spindle radius. Capacity 3" from the solid in mild steel.

E28 Made in 3 sizes with 8' 0", 9' 0", 10' 0" max. radius. Capacity 3½" from the solid in mild steel.



Type E28 Radial Drilling, Boring and Tapping Machine.

This 60 page catalogue illustrates and describes the range of K. & W. machines for the modern machine shop.



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KITCHEN & WADE LTD. *Member of the Asquith Machine Tool Corporation*

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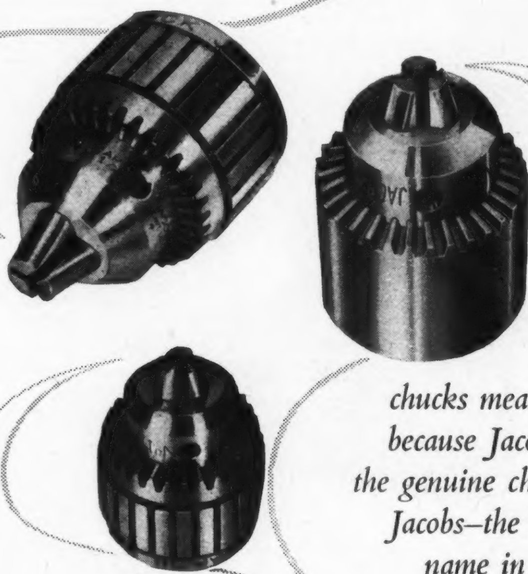
KW 457



"What I really mean to say is . . ."

"You mean chucks mean Jacobs chucks because Jacobs chucks are the genuine chucks made by Jacobs–the best known name in chucks"

"Your dealer can supply genuine Jacobs chucks in all sizes for light, medium or heavy duty"

INSIST ON GENUINE Jacobs CHUCKS

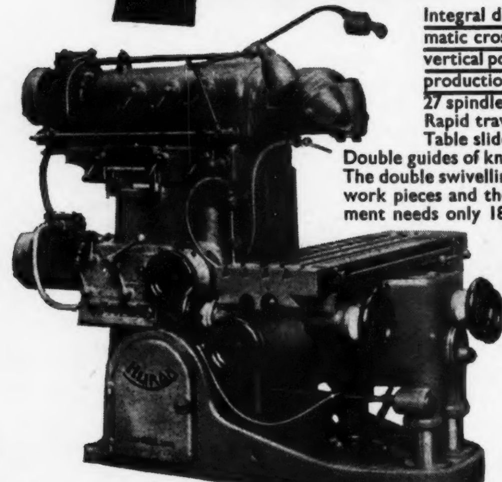
THE JACOBS MANUFACTURING CO. LTD., ARCHER ROAD, SHEFFIELD, 8

JC/4

SLIDING RAM GIVES 27½in. AUTO CROSS FEED

HEAVY DUTY MILLING

HURON SUPER UNIVERSAL MILLERS



Integral double swivelling universal head provided with 27½in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Heads can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from 1/16in. to 30in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1¼ tons to be machined. The double swivelling universal head requires an opening of only 14in. to enter work pieces and the whole sliding ram with its 27½in. automatic cross movement needs only 18in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8in. capacity under spindle. 26in. wide 8 T-slot tables and 39⅜in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

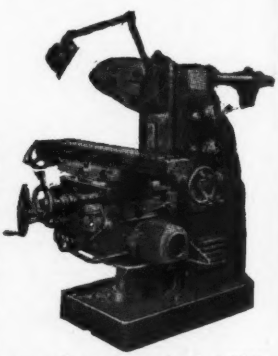
Type	Table	Automatic Feeds Long	Cross	Vert.
KU4	56 1/16in. × 15¾in.	43 5/16in.	27½in.	19⅝in.
KU5	64 1/16in. × 15¾in.	51 3/16in.	27½in.	19⅝in.
KU6	78¾in. × 16½in.	59in.	27½in.	19⅝in.
KU55	64 1/16in. × 26in.	51 3/16in.	38 9/16in.	18 1/16in.
L83	157in. × 59in.	118in.	39⅜in.	59in.

HURON MU.6/FERRANTI 3-D MILLER

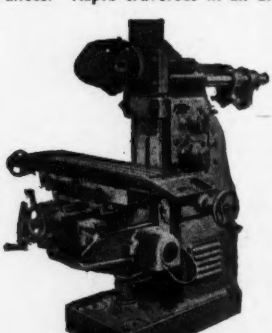
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR UNIVERSAL MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING HEAD, RETRACTABLE SLIDE BRACKET AND SPACING CASTING GIVING 26" DAYLIGHT ON No. 59 AND 21" ON No. 61



FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½in. Spacing Casting Drive assembly on 59 Machine 26in. daylight, and 21in. on No. 61.



MODELS 53 & 61. 16 universal head spindle speeds. 21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18¾in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ½-20in.

MODEL 54. Automatic cross feed of universal head 20in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds 1/16-23⅝in.

Type	Table	Automatic Feeds Long.	Cross	Vert.
53	43¼in. × 9⅞in.	27½in.	9⅞in.	15¾in.
61	47¼in. × 10⅞in.	30¾in.	9⅞in.	15¾in.
59	51 3/16in. × 11½in.	34⅝in.	11 13/16in.	21 1/16in.
54	67in. × 14¼in.	43⅜in.	14½in.	20¼in.

Send for full particulars of our very extensive range of these machines; ask for demonstration.

Rudolph Carne & Co. Ltd. SWAN WORKS, FISHERS LANE, CHISWICK, LONDON, W.4.

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Where a heavy article must be positioned before it is bolted to concrete, brickwork or masonry—use Expandabolts. If the machinery or equipment can be placed over a bolt previously fixed—choose Anchor Bolts.
Both these simple fixing devices provide a secure anchorage which remains firm under movement.

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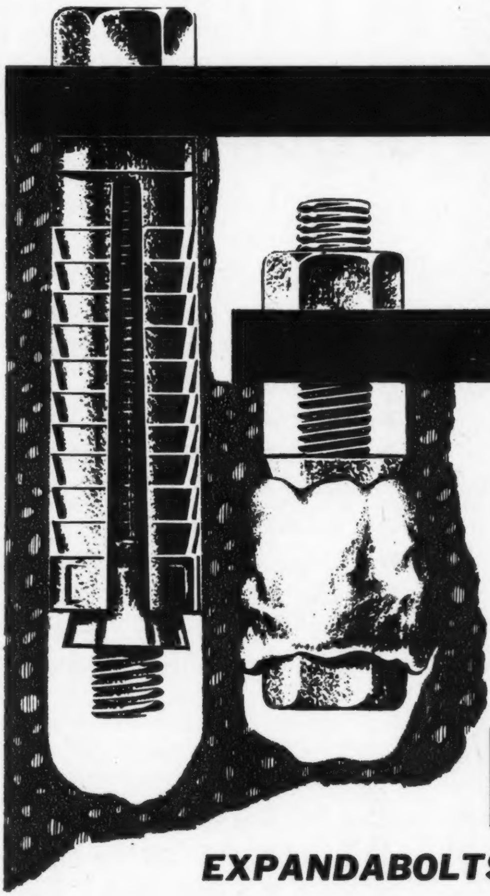

EXPANDABOLTS

A hole is made and the complete bolt (set screw, saw-toothed split-sleeve and cone wedge) is placed in it. The set screw is removed and the article placed in position. The set screw is reinserted and tightened. This draws the wedge into the split-sleeve, forcing the saw-teeth to grip the concrete.

ANCHOR BOLTS

A hole is made, the bolt is inserted and the wedge is driven into the lead spreader, thus locking the bolt in position. The article to be fixed is then placed over the protruding bolt, and the nut is tightened.

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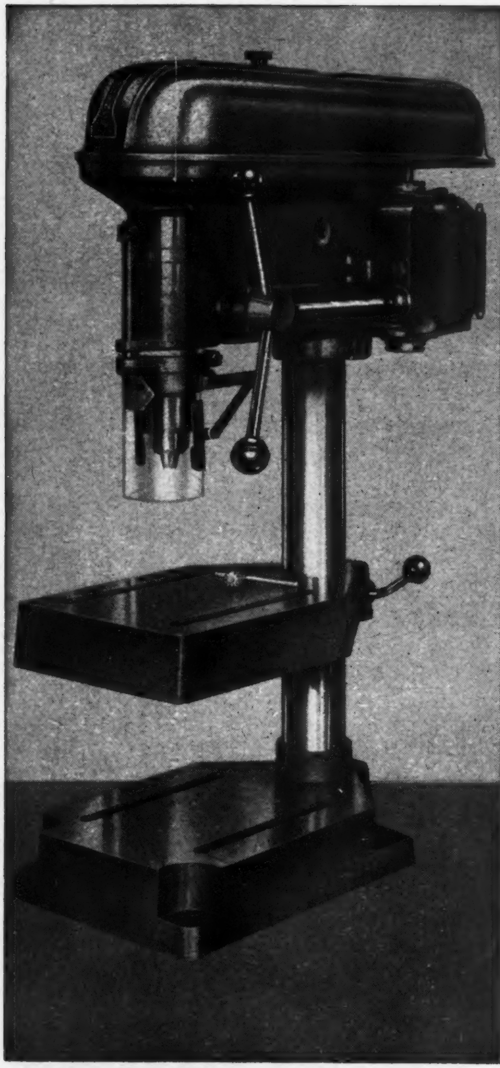

INCOMPARABLE IN PRICE & QUALITY

- Weight 154 lbs. 70 kgs.
- Five Spindle Speeds
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- Quill Diameter 2″ : 50·8 mm
- Robust Spindle and Quill Assembly with splined spindle and driving sleeve
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- Adjustable Depth Stop and Spring-controlled Spindle return

Supplied complete with 0-½in. Chuck, 3 phase motor, rotary on/off starter. Pedestal model £2.15.0 Extra. Single phase electrics £2.10.0 Extra.

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Now in handy aerosol form and even easier to use, Spectra Spray leaves a blue film which speeds marking off to very fine limits—gives greater accuracy in machining with less eye strain and lower incidence of scrap.
Each operator needing Spectra Color can now be supplied with an individual can, avoiding time loss in collecting and returning to stores.

In Transparent Blue only (6 fl. ozs.) Part No. SS1, 7/6 each. Carton lots of 12, 7/- each. 36 and above—carriage free.

Also available in other sizes and colours for brush application—write for details.

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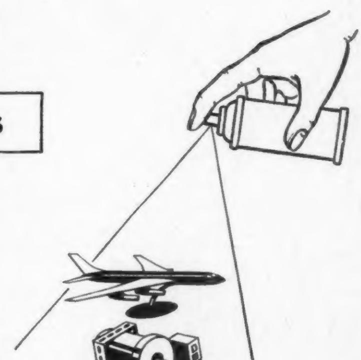
Spectra *Cellulose* Spray Paints

For the small spray job on prototypes, models, machinery, mock-ups, "one-offs" etc.



- ★ **Available for instant use**
- ★ **Saves maintenance of spray guns for small jobs**
- ★ **Dries rapidly and evenly without brush marks**
- ★ **Fine mist delivery reaches inaccessible parts**
- ★ **Special non-clogging spray head—avoids tearing**
- ★ **Available in 14 colours and primer**

These handy spray cans are so easy to use—each coat is dry in a few minutes—reducing waiting time for additional coats.

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Red	**PR**	Dark Green	**PT**
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	Primer	**PP**	

in 6 fl. oz. aerosols at 9/6 each. Cartons of six (colours to choice), 9/- each.

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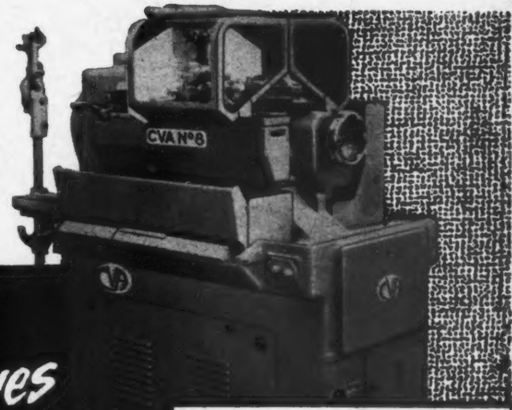
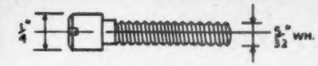
FUNCTIONAL CONSTRUCTION

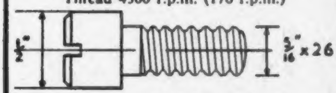
Bed mechanism fully protected by quick release covers—large aperture cabinet giving free access to motor and gearbox—large chip tray designed for easy cleaning—fully protective splash guards promoting cleanliness of machine and shop floor.



PLUS these pacemaking features



Turn 7250 r.p.m. (475 f.p.m.)
Thread 4300 r.p.m. (176 f.p.m.)

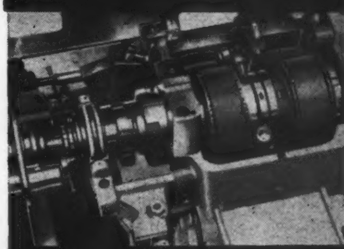


Turn 487 r.p.m. (64 f.p.m.)
Thread 37 r.p.m. (3 f.p.m.)

Two hundred and forty two-speed combinations are provided within the maximum and minimum speeds shown above

MULTI-SPEED GEARBOX

18 high speeds from 7,250 to 487 r.p.m. 15 ratios from 1·7 to 15·5 to 1. 240 low speed combinations from 4,300 to 37 r.p.m. The gearbox furnishes suitable cutting speeds for all materials from small diameter light alloys and plastics to high tensile steel of maximum diameter. The range of 15 ratios always offers a threading speed to suit the material to be cut regardless of turning speed selected.



POWERGRIP TIMING-BELTS

The exclusive non-slip belt drive combines the best features of conventional belts and chains and ensures that the full power of the 3 h.p. motor is always available at the cutting tool, permitting the use of carbide tooling.

EASY CHANGE FEED GEARBOX

All gears are mounted on fixed centres to reduce set-up time and minimise oeprator error. Gear combinations are provided for close job timing, giving 66 cycle changes from ¾ to 64 seconds, with 240 r.p.m. backshaft or 1½ to 128 seconds with 120 r.p.m. backshaft.

Other models available: No. 12— ¾" capacity
No. 20—1¼" capacity
No. 26—1⅝" capacity

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The Murad

UNEXCELLED THROUGHOUT THE WORLD FOR PRODUCTIVE CAPACITY, ACCURACY AND OPERATING CONVENIENCE

Write to-day for complete details.

MODEL 3Q (illustrated)

Max. Collet Capacity ... ¾"
Spindle Nose to Face of Turret ... ... 12¼"
Swing Over Cross Slide 4¼"
Swing Over Bed ... ... 11½"
Four Speed Ranges:
'A' ... ... 350/4,800 r.p.m.
'B' ... ... 225/3,110 r.p.m.
'C' ... ... 150/1,940 r.p.m.
'D' ... ... 85/1,030 r.p.m.

MODEL I STANDARD

Max. Collet Capacity ... 1"
Spindle Nose to Face of Turret ... ... 12¼"
Swing Over Cross Slide 4¼"
Swing Over Bed ... ... 11¼"
Speed Range as for Model 3Q

Please write for full technical details of the above and other models, including the 1A, 1B, VELOMATIC and 3C.

MURAD DEVELOPMENTS LTD.

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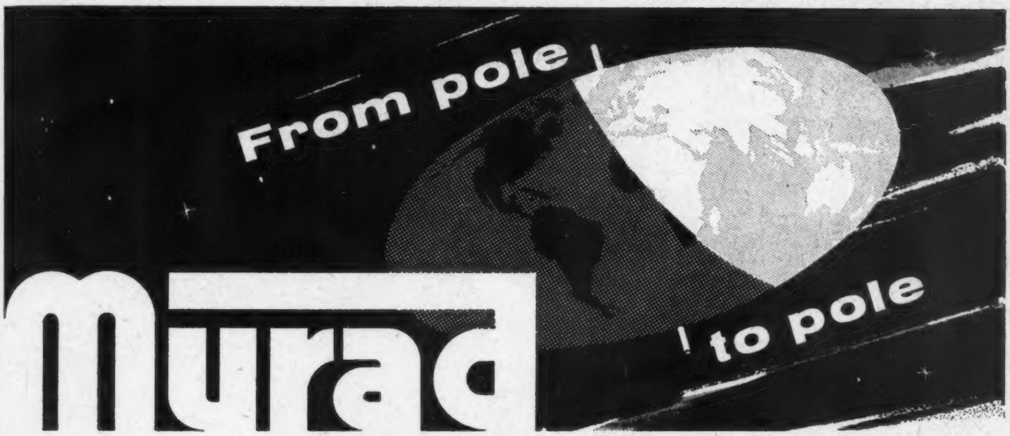

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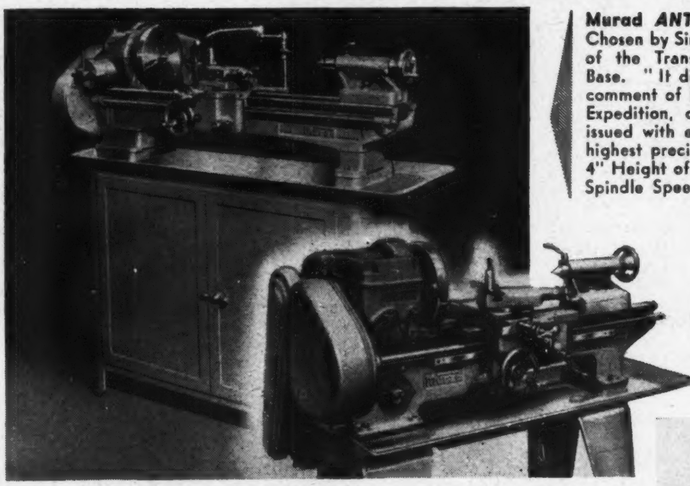
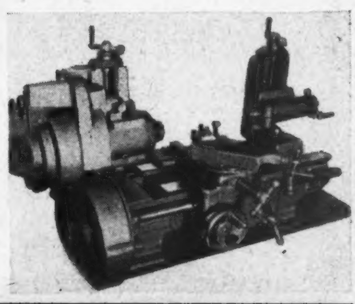


Murad *ANTARCTICA* Precision Lathe
Chosen by Sir Vivian Fuchs to service the equipment of the Trans-Antarctic Expedition at Shackleton Base. "It did everything we asked of it," was the comment of Mr David Pratt, Chief Engineer of the Expedition, on his return. A Test Certificate is issued with each machine showing it to be of the highest precision.
4" Height of Centres, 18" or 24" between Centres. Spindle Speeds 40 - 1,600 r.p.m.

The Cadet
All geared head centre lathe. It was chosen for the R.N.Z.N. Ship "Endeavour" which serviced Sir Edmund Hillary's part of the Trans-Antarctic Expedition at Ross Bay.
4" Height of Centres, 18" or 24" between Centres.

Get the details of these well proven machines . . today

The Bormilathe
An outstandingly versatile machine, is an entirely new type of Machine Tool capable of carrying out boring, milling and turning and every type of wood-working. A Bormilathe is now on its way to the Arctic Region for the use of an Expedition by the Canadian Department of Northern Affairs and National Resources.
From Pole to Pole, men who direct great enterprises choose Murad.



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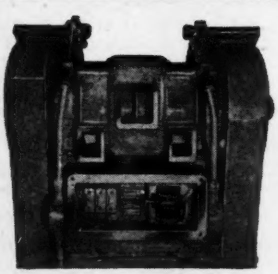
THE NEW MURAD EG8 DUSTLESS GRINDER

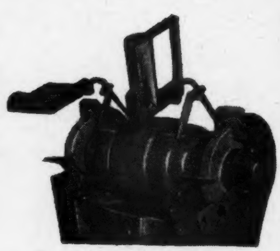
- ***Filter Resistance Halved***
- ***Impeller Capacity Trebled***
- ***Eye Shields and Local Lighting***
- ***Now Standard***

These are some of the many improvements embodied in the new EG.8 making it without question the best off-hand Grinder in the world. The Murad Dustless Grinder is unique. It embodies its own dust inhibitor which offers protection to both worker and employer and makes the provision of a separate dust extraction plant unnecessary. It can be placed anywhere in the shop to suit the sequence of operations, even in close proximity to precision machines without endangering their slides. The repeat order is the finest tribute that a customer can pay to the efficiency and reliability of a machine tool. Britain's industrial giants have paid this tribute to the Murad Dustless Grinder.

Amongst many Users who send us a constant stream of repeat orders are such world-famous firms as Mullards, Pressed Steel, G.E.C., Atomic Energy Authority, A.E.I., British Oxygen, Gillette Industries, Skefko, etc., etc.



Control switchgear is designed into the machine and not added as an afterthought.



The above illustration shows the eyeshield swung up for ease in changing lamps, etc.

Pat. No. 674748

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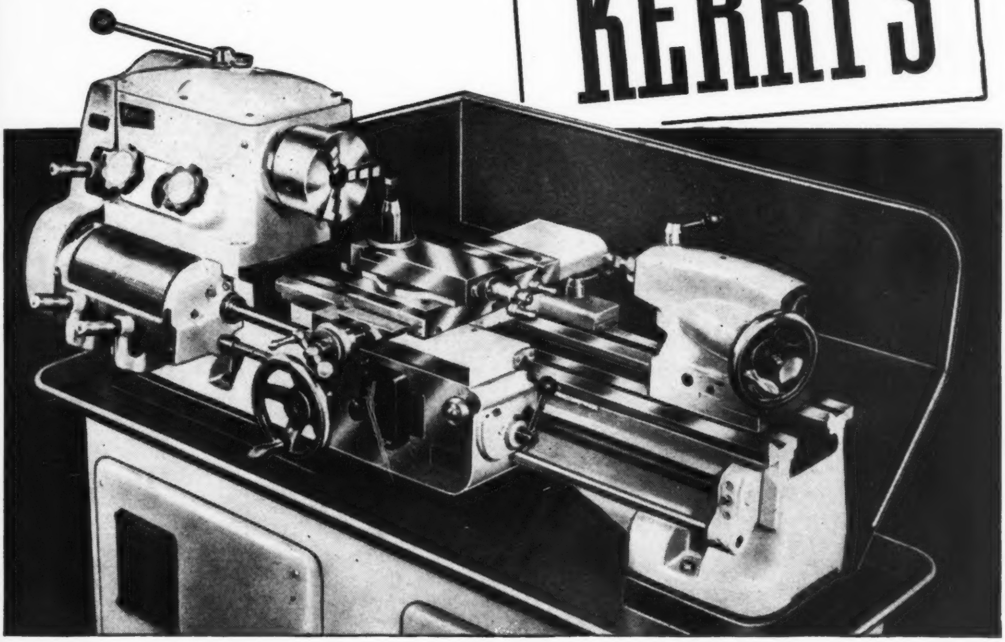

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- ★ BEDWAYS AND SLIDES PRECISION GROUND
- ★ HARDENED BEDWAYS OPTIONAL EXTRA

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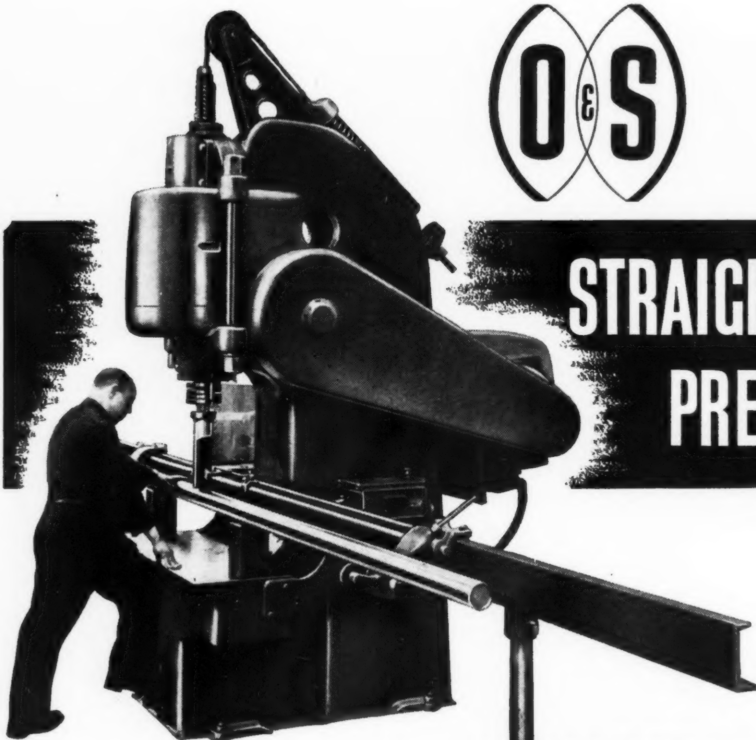
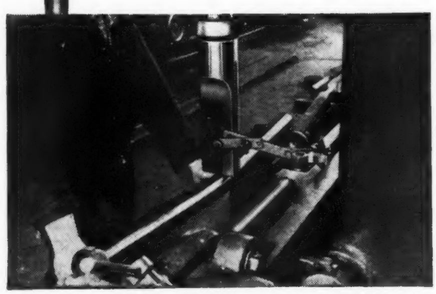
O & S

STRAIGHTENING PRESSES





In the Leicester works of Frederick Parker Ltd., O & S Straightening Presses are in daily service ensuring that steel shafts are perfectly straight and true.

O & S Straightening Presses, made in 5 sizes with capacities ranging from 4 to 60 tons pressure, have for many years been the first choice of engineering firms throughout the world, including most of the leading motor manufacturers. For speed, accuracy and ease of operation, O & S Straightening Presses are in a class of their own.

O & S

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A Kerry COMPANY

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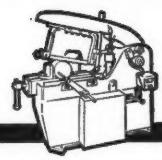
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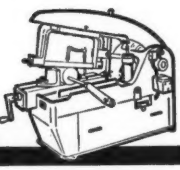
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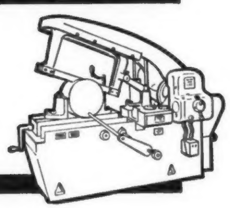
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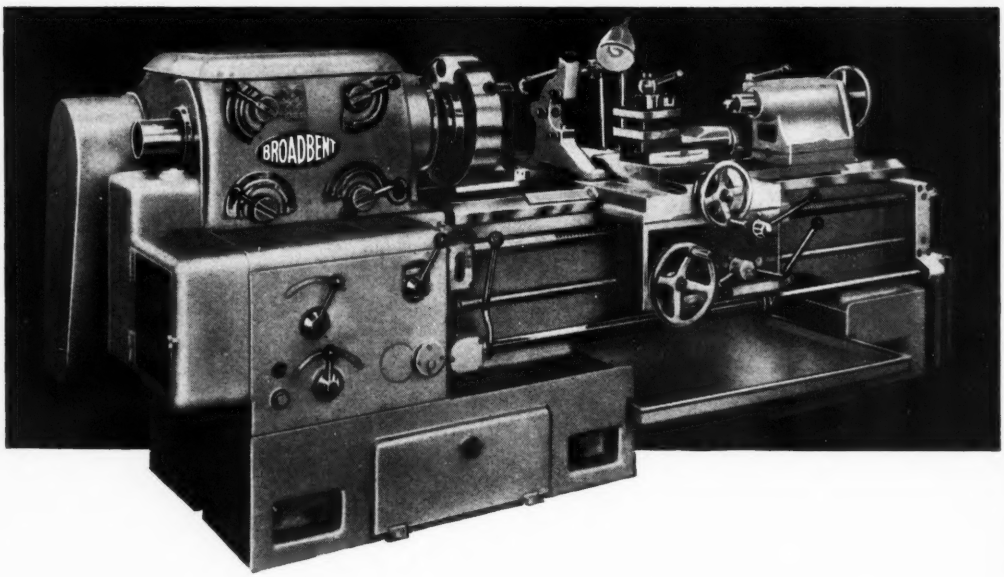

This 18/22″ Swing Heavy Duty Centre Lathe of modern design is a typical example of the Broadbent range. It has a 15 h.p. drive motor and spindle speeds up to 1,000 r.p.m.

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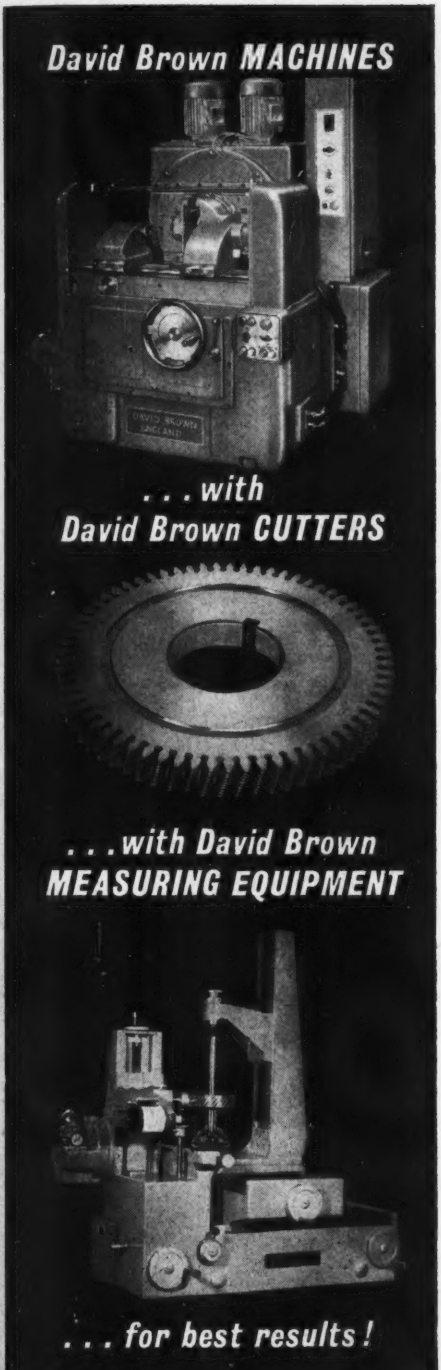

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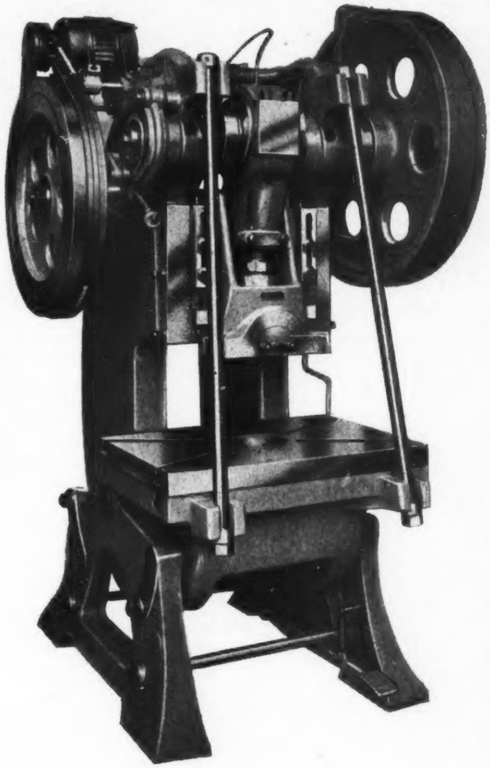

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- ★ BODY & TABLE IN ONE HIGH-GRADE GREY IRON CASTING
- ★ CRANKSHAFT AND STROKE ADJUSTING BUSH OF NICKEL CHROME STEEL
- ★ PRESSURE LUBRICATION SYSTEM
- ★ FRONT TIE BARS
- ★ BRITISH-MADE ELECTRICAL EQUIPMENT

SPECIFICATIONS

TYPE	T.180	T.120	T.100	T.60	T.40	T.40 U.G.	T.30	T.30 U.G.	T.20 U.G.
Approx. Normal Pressure	180 Tons	120 Tons	100 Tons	60 Tons	40 Tons	40 Tons	30 Tons	30 Tons	20 Tons
Strokes per Min.	30	30	40	60	70	110	90	90	100
Stroke Ajj. from	¾"—7"	¾"—5½"	⅝"—4½"	½"—4½"	⅜"—3¾"	⅜"—3¾"	½"—3½"	½"—3½"	½"—2½"
Size o Bed	39½" × 27½"	39½" × 26"	35½" × 24½"	29½" × 17½"	26" × 15¾"	26" × 15¾"	15" × 22¾"	15" × 22¾"	13" × 18"
Depth of Throat	14½"	14"	13"	9½"	8¾"	8¾"	7¾"	7¾"	6¾"
Height of Bolster to Guides	18"	18"	15½"	13½"	12¾"	12¾"	11¾"	11¾"	11"
Max. Shut Height	12½"	11½"	10¾"	9¾"	8¾"	8½"	9"	9"	9"
Distance between Frames	17½"	15"	14"	11¾"	11"	11"	9"	9"	9"
PRICE:	£2,661	£1,666	£1,473	£898	£715	£656	£532	£468	£425

U.G. Signifies Un-geared Machine

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- Plano milling heads for cross rail and side boxes available

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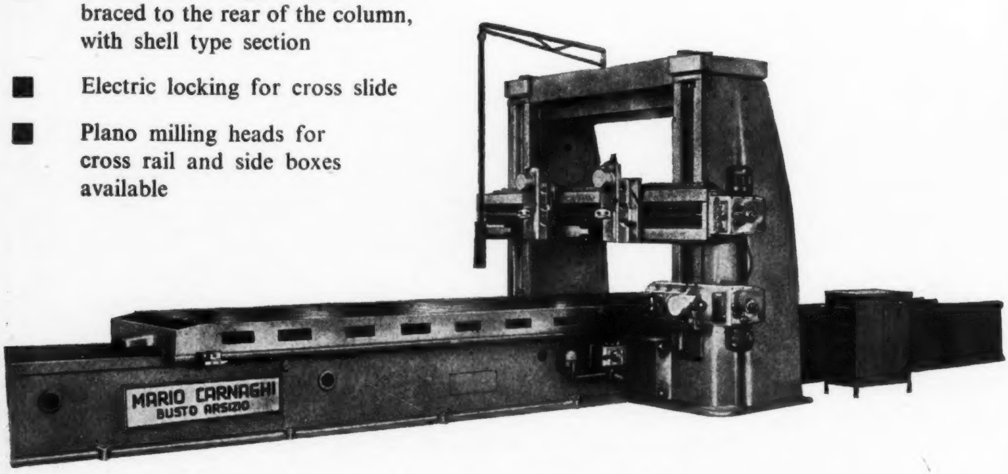

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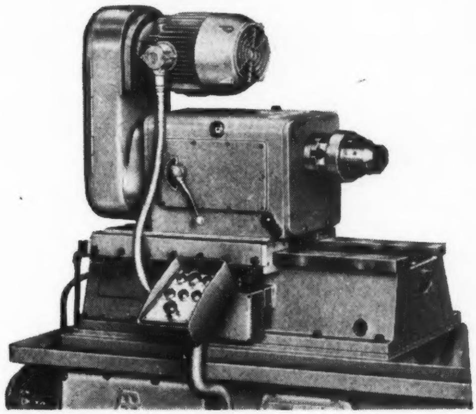

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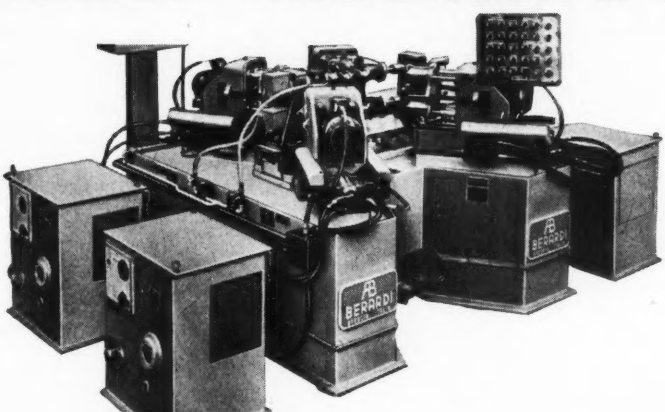

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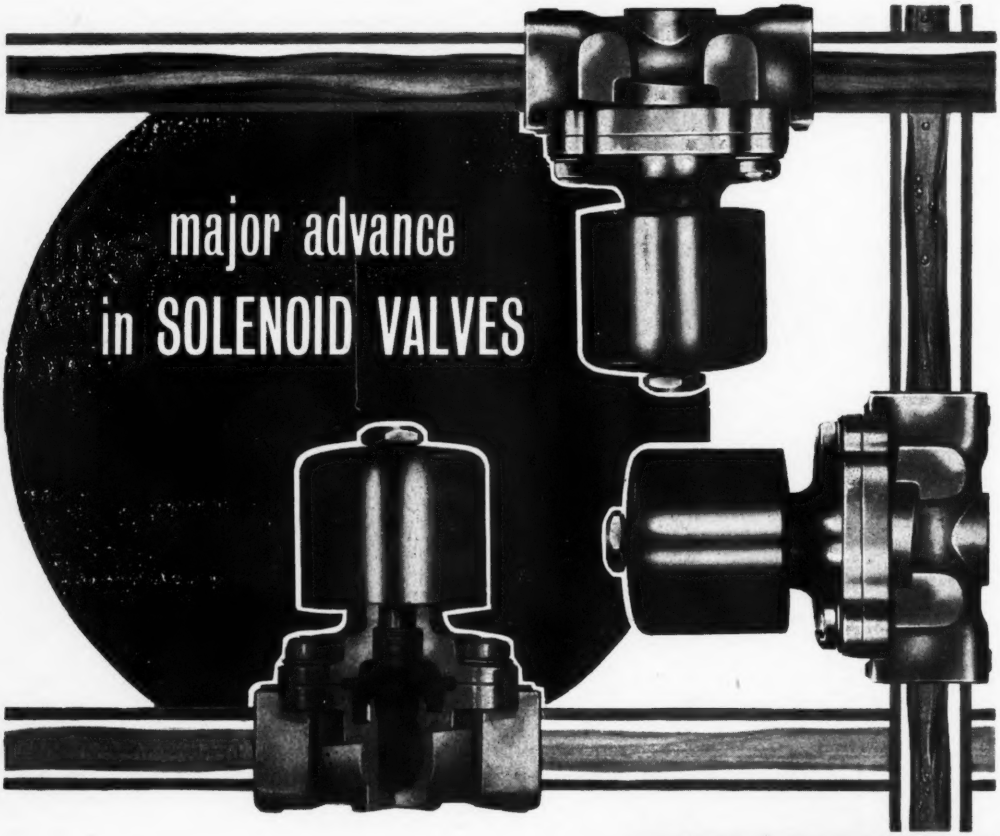

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MOUNT this new Dewrance ASCO Low Pressure Solenoid Valve in any position without affecting its operation. For pressures up to 7 psi, the Bulletin 8030A helps give full design flexibility to gas pilot applications on industrial ovens and furnaces—automatic dispensing and vacuum holding applications. This valve combines ruggedness with simplicity by housing a single moving element—the stainless steel core and composition disc—in an extra heavy forged brass body. Operation is just as remarkable. Energizing the solenoid with only 10 watts provides positive opening action. Both $\frac{3}{8}$" and $\frac{1}{2}$" pipe sizes feature oversized ports ($\frac{5}{8}$" orifice) for greater flow at an exceptionally low pressure drop. There's one source that solves virtually any solenoid valve problem—Dewrance ASCO. For full data on this new Low Pressure Solenoid Valve, write today for Application and Development Report 8030A.

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Soldering and brazing by induction are quicker and cleaner than by conventional methods. Localised heating restricts the flow of solder to the joint area. Both parts to be joined are raised to working temperature together. Scale and discoloration are reduced to a minimum.

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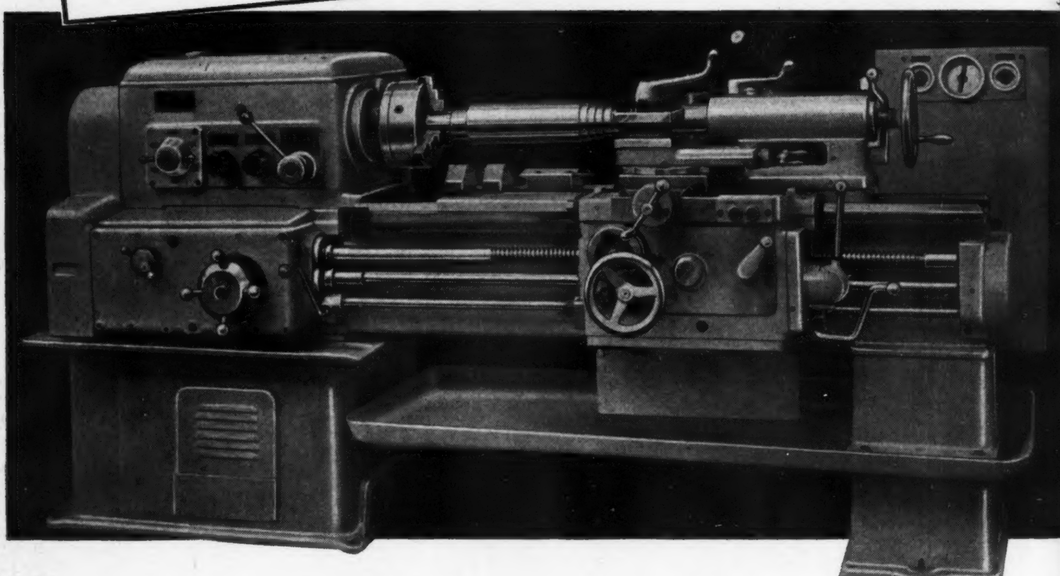
TOOL ROOM LATHE



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- High spindle speeds for use with ceramic tip tools.
- The availability of 24 spindle speeds and 42 feeds allow the most productive speeds and feeds to be selected for each job.
- Carriage and cross slide travel are controlled by means of a single lever. The direction of tool travel coincides with the direction of lever shift.
- The load on the cutting tool may be checked by specially provided devices at any time during operation.
- Feeds in any direction are disengaged by a single lever. Pressing a button, built into this lever, engages rapid traverse of the carriage and cross slide. The direction of lever shift coincides with the direction of carriage and cross slide.
- A special electric motor is provided for rapid movements of the carriage.

£1850

DELIVERY JAN/FEB 1962

SPECIFICATION

CAPACITY

Distance between centres......4ft 8in.
Height of centres .... 8½in.
Maximum diameter of bar stock machined .... 1¾in.
Maximum diameter of workpiece machined over lower part of cross slide......8½in.
Maximum diameter of workpiece accommodated over bed ....15¾in.
Maximum length turned (according to distance between centres)....4ft. 4¼in.
Pitches of threads cut:
- Metric threads, mm.............1 to 192
- English threads, t.p.i...........24 to 2
- Module threads, module ......0.5 to 48
- Pitch threads, D.P. .... 96 to 1

SPINDLE

Spindle taper .... Morse No. 6

CARRIAGE

Maximum longitudinal travel (according to distance between centres)......4ft. 4¼in.
Maximum cross slide travel..........10in.
Maximum tool slide travel..........5½in.
Maximum swivel of tool slide, deg. ±90
Number of cross slides:
- Front 1
- Rear 1

Maximum distance from line of centres to edge of four-way tool block........9½in.

Number of tools in tool block..........4
Maximum size of tool shank (width × height) ....1in.×1in.

TAILSTOCK

Tailstock spindle taper..Morse No. 5
Tailstock spindle travel..............8in.

SPEEDS AND FEEDS

Number of spindle speeds............24
Range of spindle speeds, r.p.m. 12.5 to 2,000
Number of feeds 42
Range of feeds, inches per spindle revolution:
- Longitudinal carriage feeds 0.0027in. to 0.163in.
- Cross slide feeds....0.0013in. to 0.081in.

Rapid carriage and cross slide traverse, inches per min. .... 0.133in.

DRIVE, SPACE OCCUPIED AND WEIGHT

Three-phase A.C. electric motors:
- Main drive:
  - Power, h.p. 13
  - Speed, r.p.m. 1,500

Rapid carriage and cross slide traverse:
- Power, h.p. 1⅓
- Speed, r.p.m. 1,500

Overall dimensions, length........10ft. 6in.
Net weight .... 2 tons 7 cwts.

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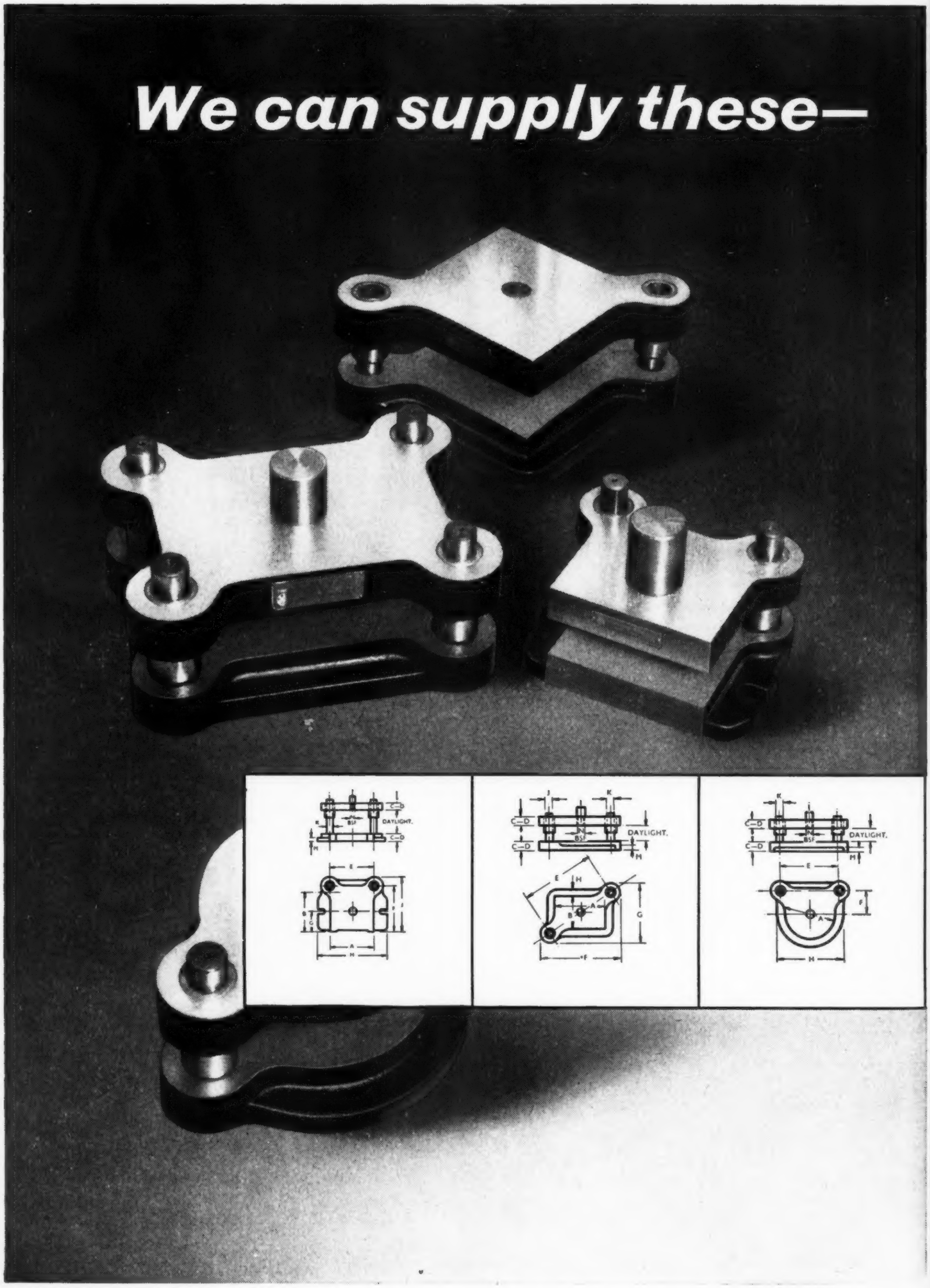
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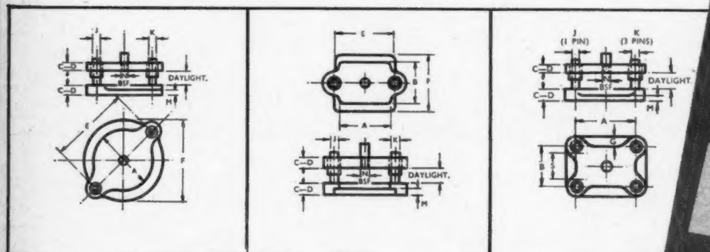
And you get them immediately from stock. Cut out the costly drawing office hours. Cut out unprofitable work in the tool room. Cut out wasteful requisitioning, costing and progress work. Turn instead to WDS die sets. There is an extensive range of types and sizes. Each set is available in varied combinations of pillars, bushes and shanks. Altogether, these standard sets cover most requirements in piercing, forming, and blanking presswork. And you get them when you want them.
In fact if you're tooling up now, you could have your dies by this time next week—and know in advance the exact cost!

TOOL UP THE WOODSIDE WAY



Write for a copy of this catalogue of Standard Die Sets ▶

Look through it, and you'll see the advantage of standardising on Woodside.
Standard Die Sets are some of the latest additions to the WDS range which includes basic tooling accessories in many individual forms and sizes.

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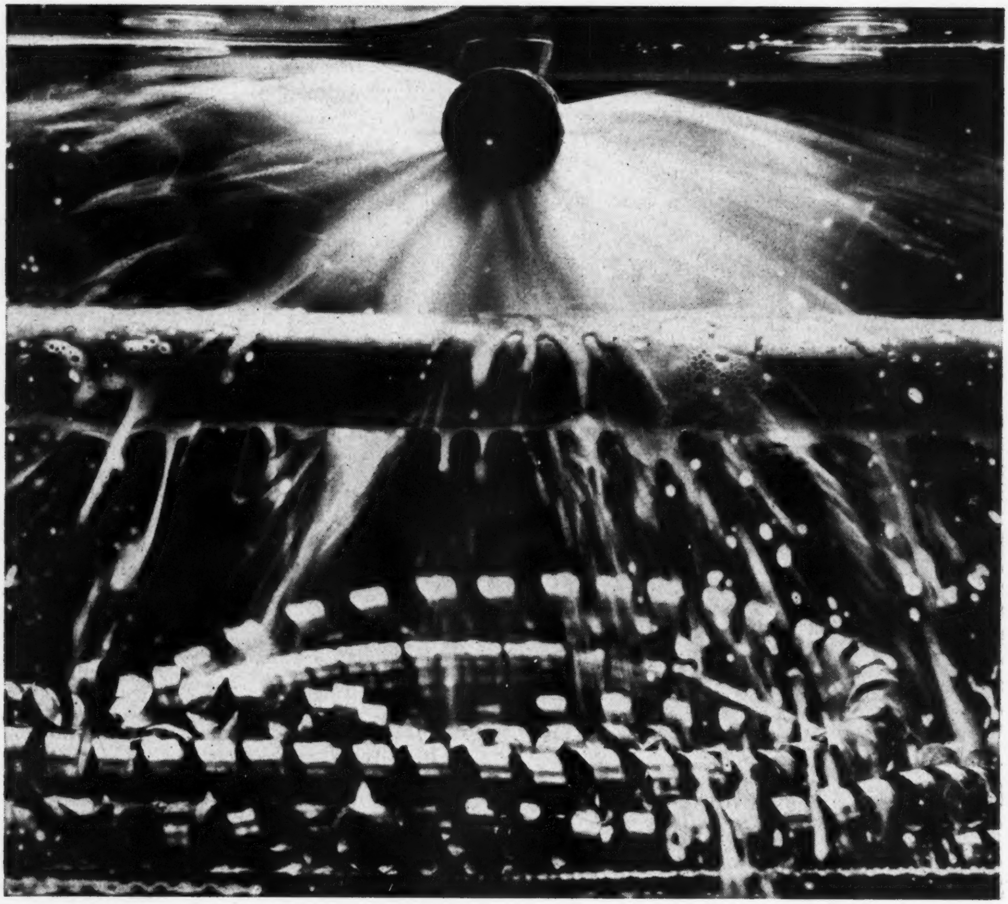
Shell demonstration



The stability and anti-rusting properties of soluble cutting oils vitally affect the sustained performance of a machine tool.

Shell Research has painstakingly studied these qualities by the comparative evaluation of different emulsifying and coupling agents. This Shell-devised rig, the Shell Emulsion Stability Test, simulates under strict control, but more severely than usual industrial applications, the conditions in which soluble oils operate.

A gallon of the emulsion is circulated continuously for 48 hours through a copper feed-pipe and over a heated iron tube before percolating back to the sump through a layer of steel turnings. Water evaporation is made up at prescribed intervals and at the end of the test.

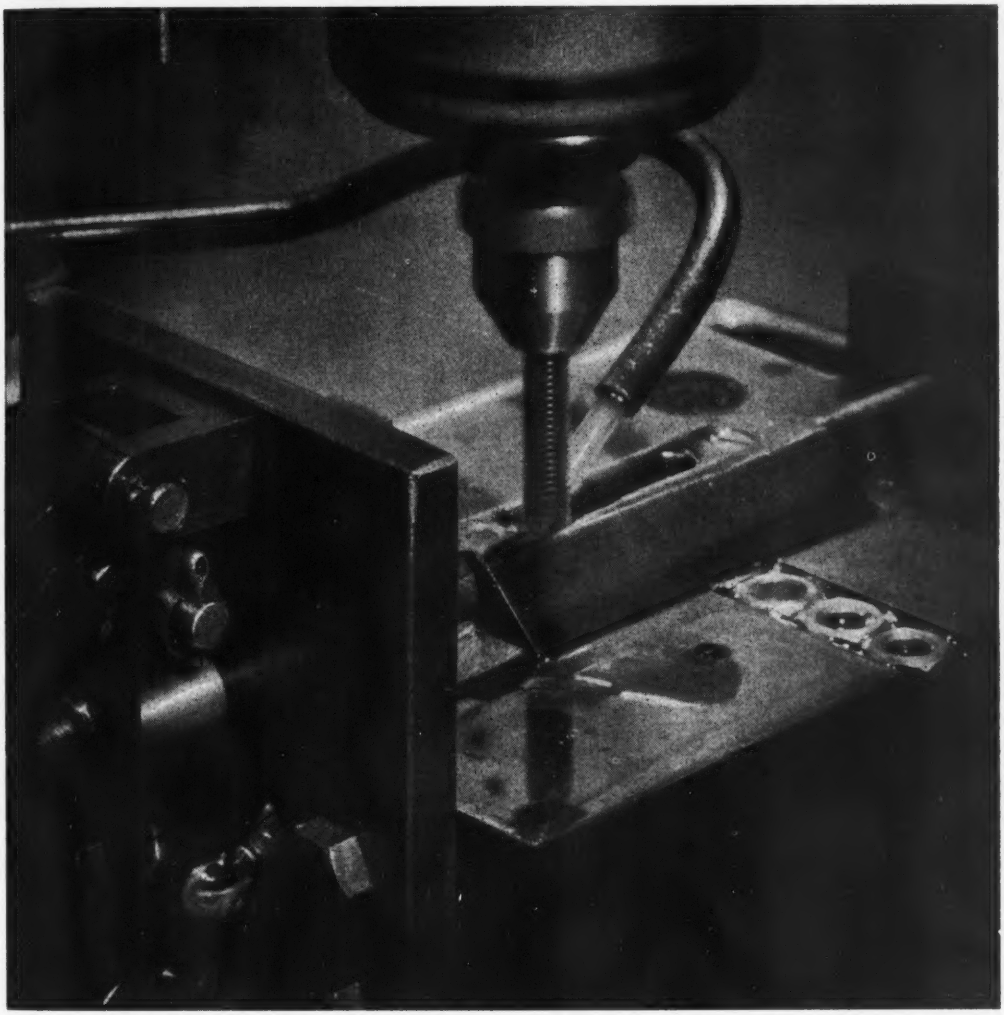
The appearance of the oil and the condition of the feed-pipe, iron tube and turnings reveal the extent of the corrosion.

By comparing the percentage change of oil content in the slurry before and after the test, the stability of the emulsion can be expressed quantitatively.

Write for the booklet, Selecting Your Cutting Oils, to Lubricants Dept., Shell-Mex House, London, W.C.2.

SHELL INDUSTRIAL OILS

Shell achievement



A famous aero-engine firm found it could drastically reduce the cost of producing nuts made from S.62 steel, by changing over from conventional cutting oils to Shell Garia Oil 115. The facts are these. S.62 steel is heat-resistant and stainless. The quality of this steel and the call for very fine tolerances, as well as a very high percentage of full depth of thread, presented costly manufacturing problems. The breakage of taps, the need for constant re-setting, and the high proportion of rejects, built up the average cost of the nuts to over 1s.2d. each.

By accepting the advice of the Shell engineer and changing over to Shell Garia Oil 115, this firm was able to produce 3,000 nuts between regrinding taps –resulting in the cost of each nut being reduced to 3d. *Write for the booklet 'Selecting Your Cutting Oils' to Lubricants Dept., Shell-Mex House, London, W.C.2.*

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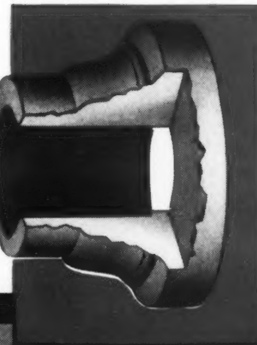

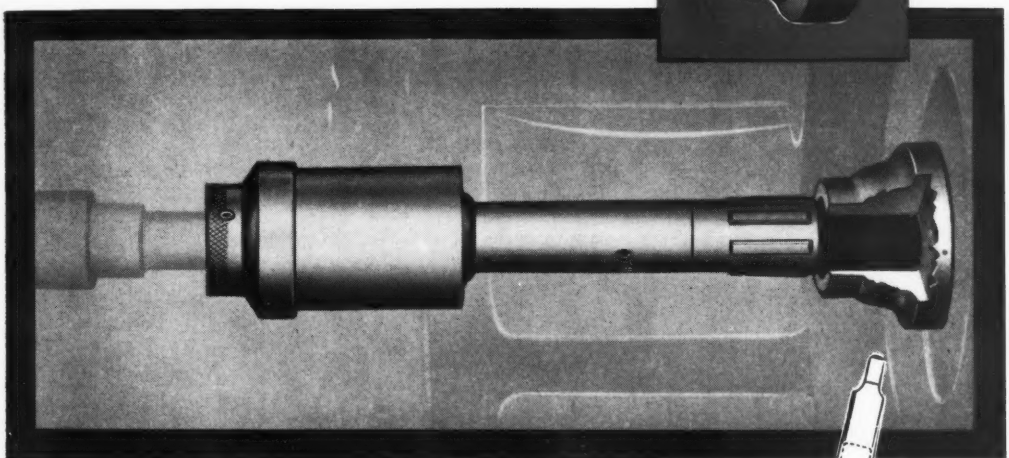

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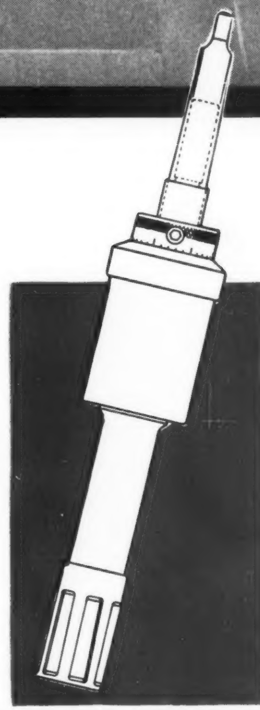

- Finishes rough bored or turned surfaces (125 micro-inches and higher) to 4 micro-inches and lower. Feed rates of 8 to 12 inches per minute.
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- Run thousands of parts without tool wear. No resetting or adjustment. No stones to replace, maintain or adjust.
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MAC 99

HIGH-SPEED DIE CASTING MACHINE

BRITISH AND FOREIGN PATENTS

- **NEW** 4-way adjustable die unit.
- **NEW** brush device (British and foreign patents) cleans and lubricates die faces, adjustable angle—optional extra.
- **NEW** Automatic cycling—optional extra.
- Push button panel
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- Broader and sturdier base
- Solenoid-operated valve system with speed control
- Exhaust mufflers for quiet operation
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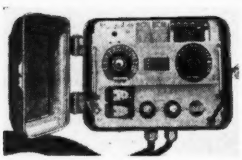
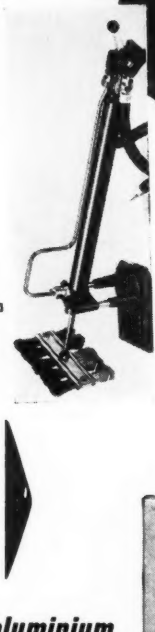
- Capacity 12 ozs. Zinc Alloy

ELECTRONIC TIMER UNIT



Optional extra electronic timer unit entirely enclosed in a metal container. Can be attached instantly to the control panel with quick connect plugs, and be placed away from machine.



NEW BRUSH DEVICE

Optional extra—New brush device (British and foreign patents) air operated, cleans and lubricates the die faces. Mounted on a swivel plate to give an adjustable angle to the brush stroke.

DESIGNED ESPECIALLY FOR DIE CASTING PLANTS

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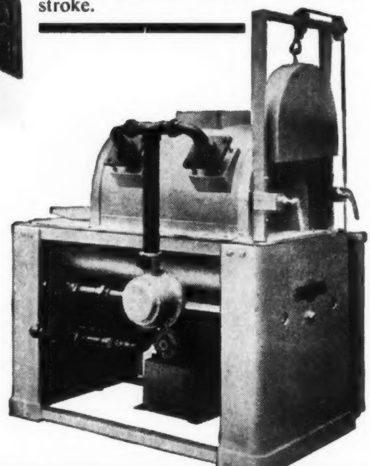

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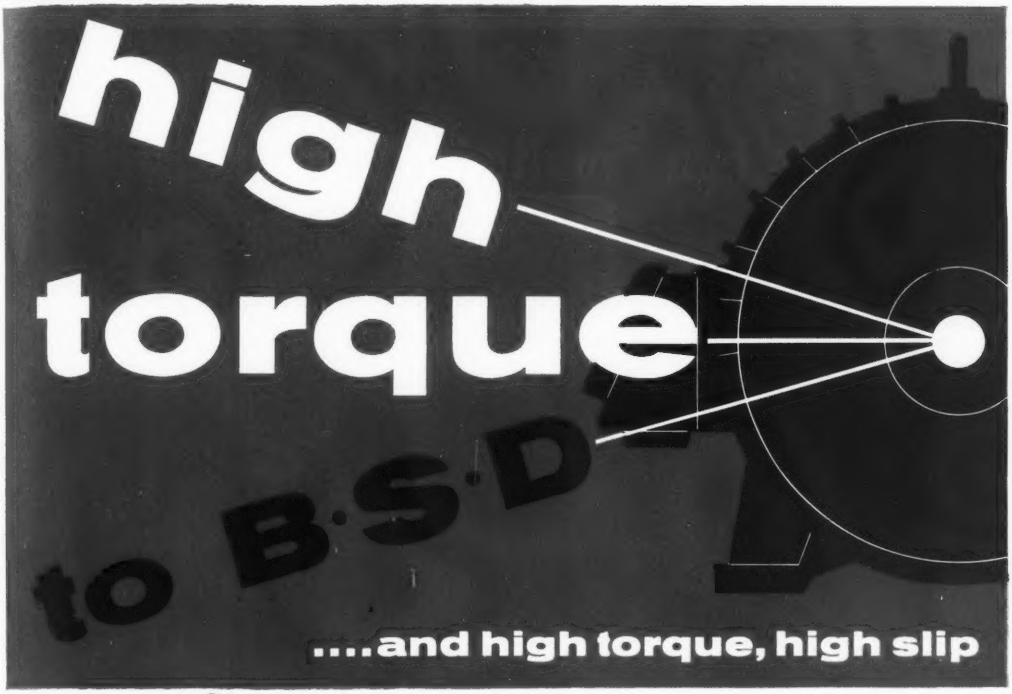

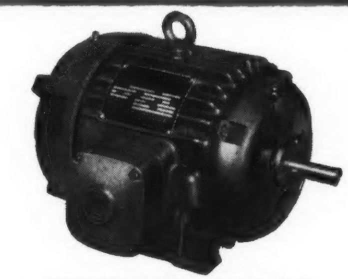

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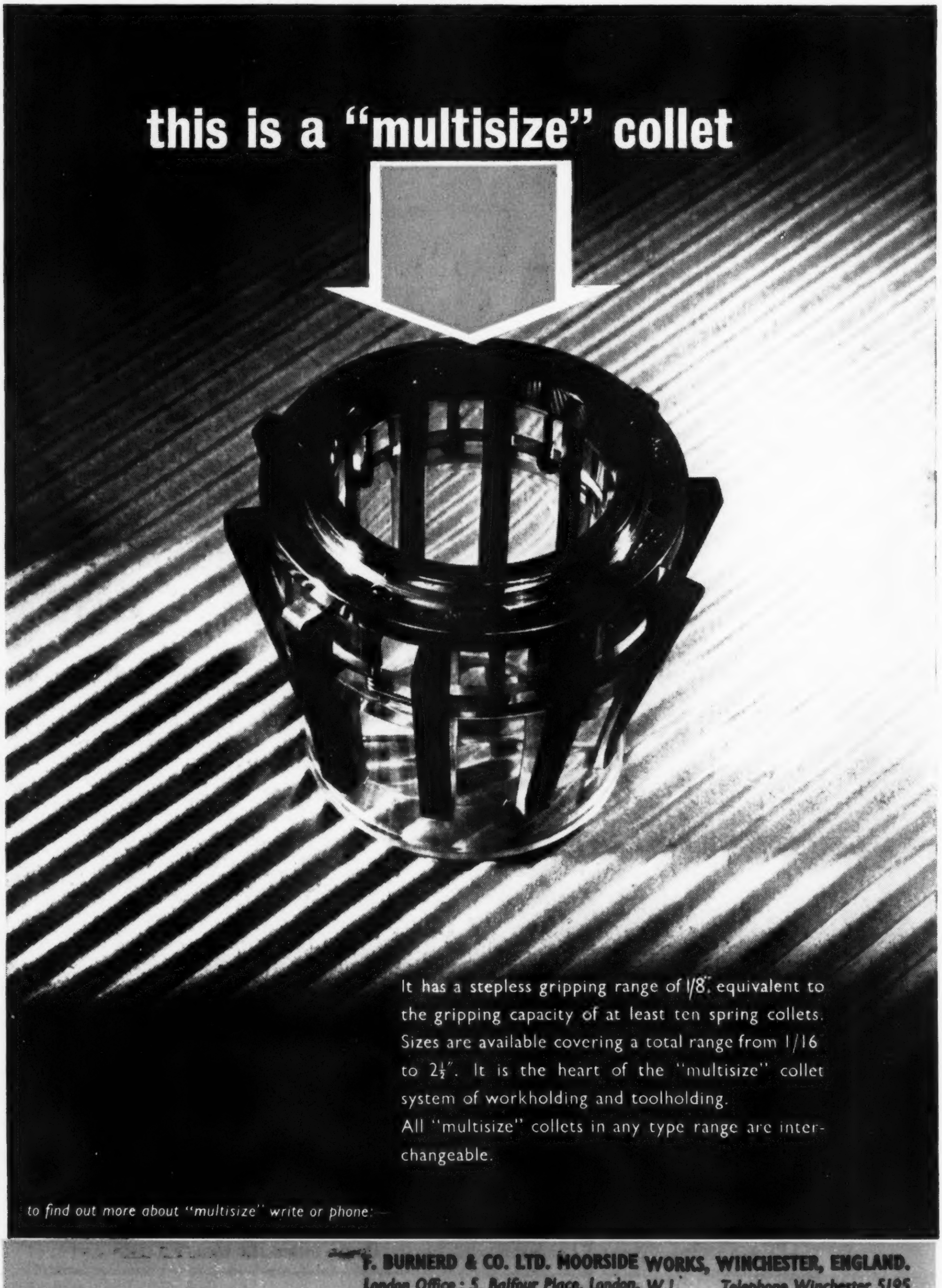
high torque industrial motors

The English Electric Company Limited, English Electric House, Strand, London, W.C.2.

DM.100A


this is a "multisize" collet
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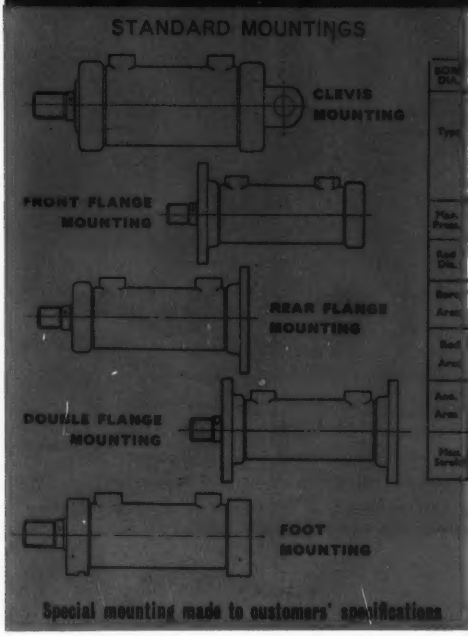

Bore Dia.	1"	1½"	2"	2"	2¾"	2¾"	3¼"	4"	4"	5"	6"	7½"
Type	3060 and A, B, C, or D.	3544 and A, B, C, or D/80	1957 and A, B, C, or D/80	1957 and A, B, C, or D/123	1851 and A, B, C, or D/220	1851 and A, B, C, or D 227	4295 and A, B, C, or D/80	2867 and A, B, C, or D/80	2867 and A, B, C, or D/152	2434 and A, B, C, or D/80	2868 and A, B, C, or D/93	5619 and A, B, C, or D.
Max. Press.	1000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Rod Dia.	½"	1 1/16"	1"	1⅜"	1⅜"	1 15/16"	2"	2"	2⅞"	2½"	3¼"	4"
Bore Area	·7854 □"	1·7671 □"	3·142 □"	3·142 □"	5·94 □"	5·94 □"	8·296 □"	12·57 □"	12·57 □"	19·64 □"	28·27 □"	44·179 □"
Rod Area	·1964 □"	·8866 □"	·785 □"	1·49 □"	1·49 □"	2·948 □"	3·142 □"	3·142 □"	6·492 □"	4·908 □"	8·296 □"	12·566 □"
Ann. Area	·5980 □"	·8805 □"	2·357 □"	1·652 □"	4·45 □"	2·992 □"	5·154 □"	9·424 □"	6·072 □"	14·727 □"	19·978 □"	31·613 □"
Max. Stroke	up to 6"	up to 40"	40"	40"	70"	70"	75"	80"	80"	100"	130"	144"

Note: 1. Longer stroke lengths are available for certain applications.
2. Cylinders can be manufactured to specific requirements.
3. Special rods are available.

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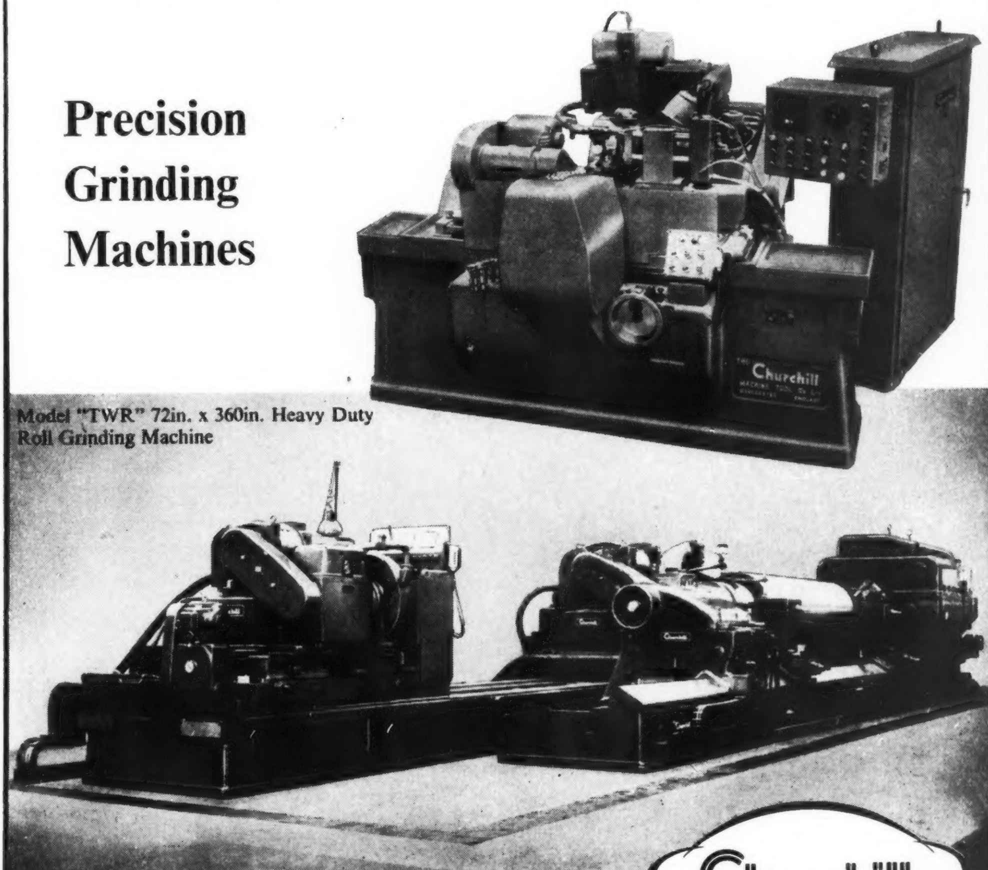

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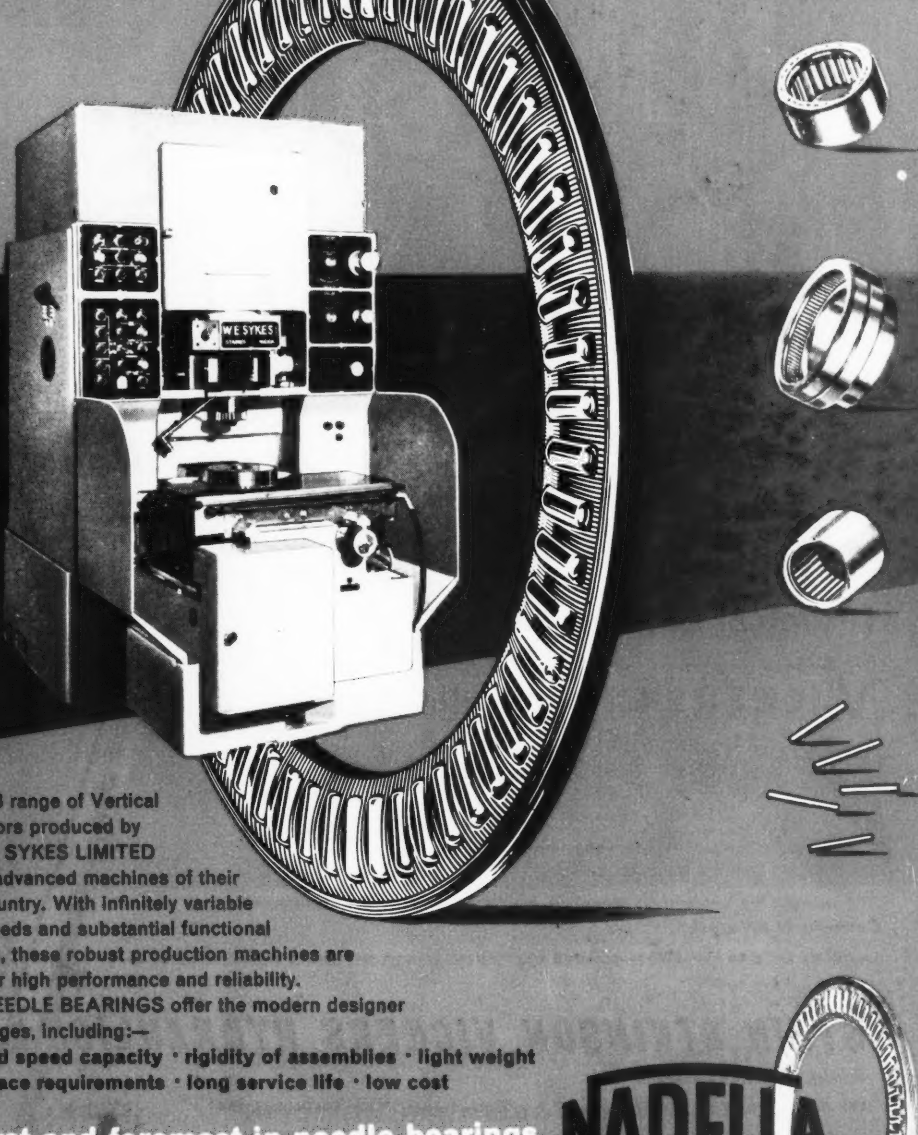
Nadella Needle Bearings are incorporated in the new V10B range of VERTICAL GEAR GENERATORS



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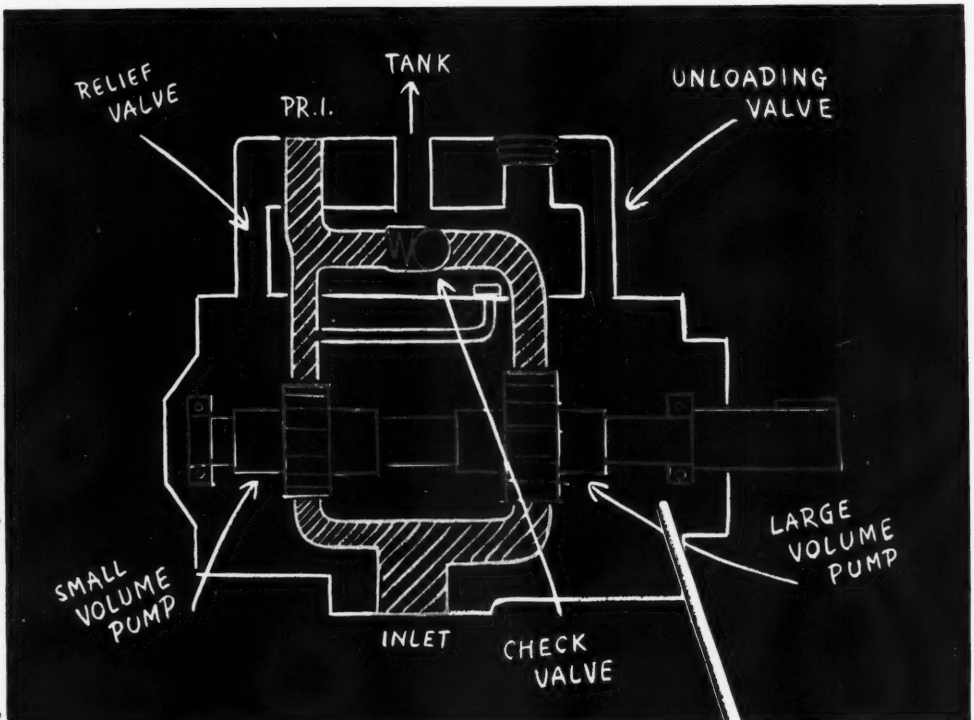

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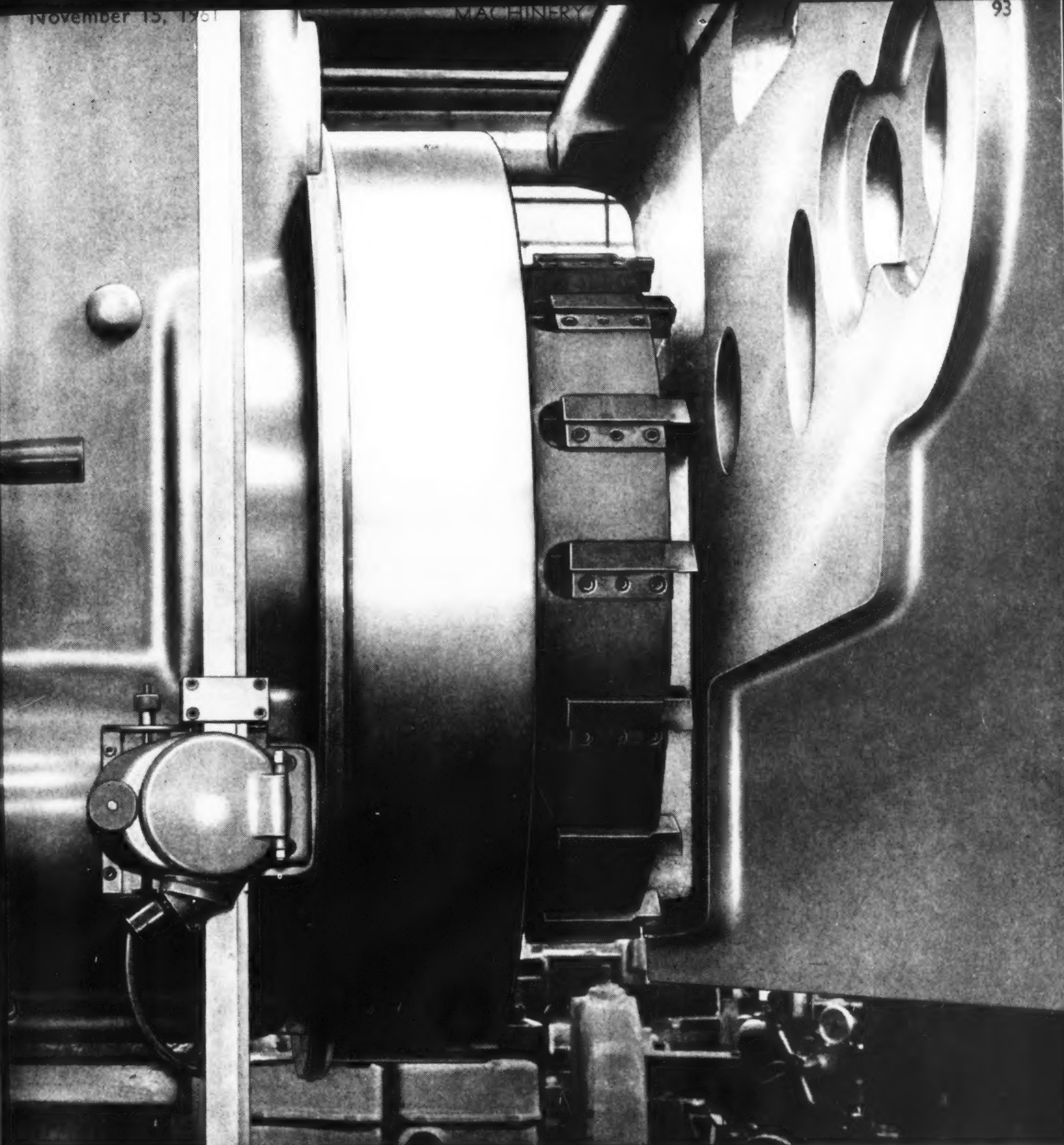

A No. 3 WB Kearns Patent Horizontal Surfacing, Boring, *Milling*, Drilling and Tapping Machine, equipped with Microptic Optical Measuring, machining location faces in cast iron using a 20" dia. face milling cutter; depth of cut ¼"; feed 10"/min. This machine, one from many in the Kearns range, can take a workpiece of up to 10 tons.

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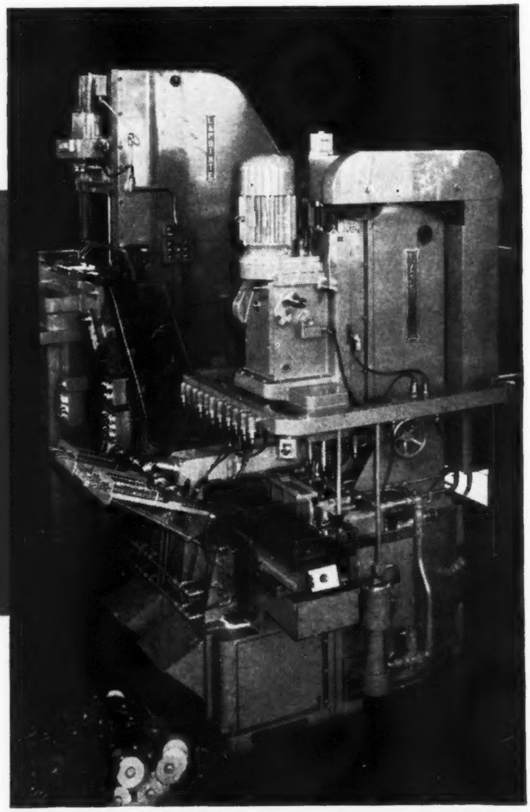

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with automatic feed and delivery.
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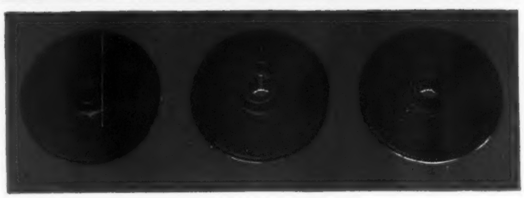
many modern industries.



LAPOINTE STATISTICS
Drilling—Standard V2 Broaching Machines
Pulling Capacity 20,000 lb.
Broaching Speed Variable between 5-25 ft/min

come to LAPOINTE for better broaching

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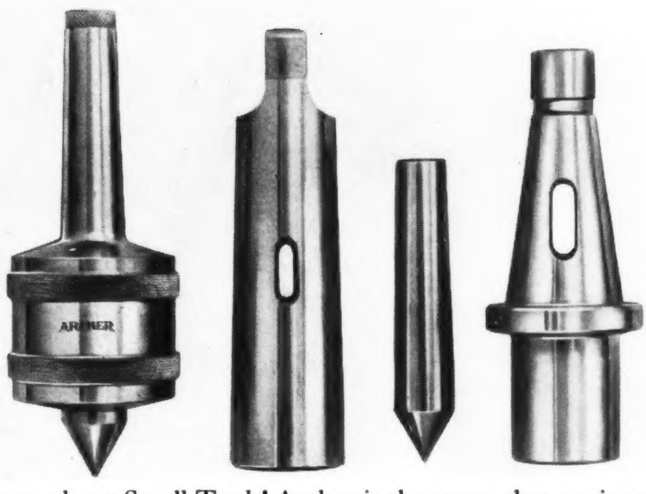

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MATERIAL TO BE MACHINED	TYPE OF OPERATION			
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COPPER BRASS · BRONZE	U or B1	B1	V	V
ORDINARY CAST IRON	U	U or B1	V	V
CHILLED IRON ROLLS STEEL ROLLS	B1	B1	V	V
MEEHANITE 'BEST QUALITY' CAST IRON CLOSE GRAIN C.I. ALLOY CAST IRON	U or VL.23	B1 or VL.23	V or VL.12	V or VL.12
STEEL	VL.45	VL.23	VL.12	VL.12
STAINLESS AND 'NIMONICS'	U	U or V	V	V

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MACHINING

TO FINE LIMITS

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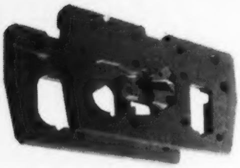

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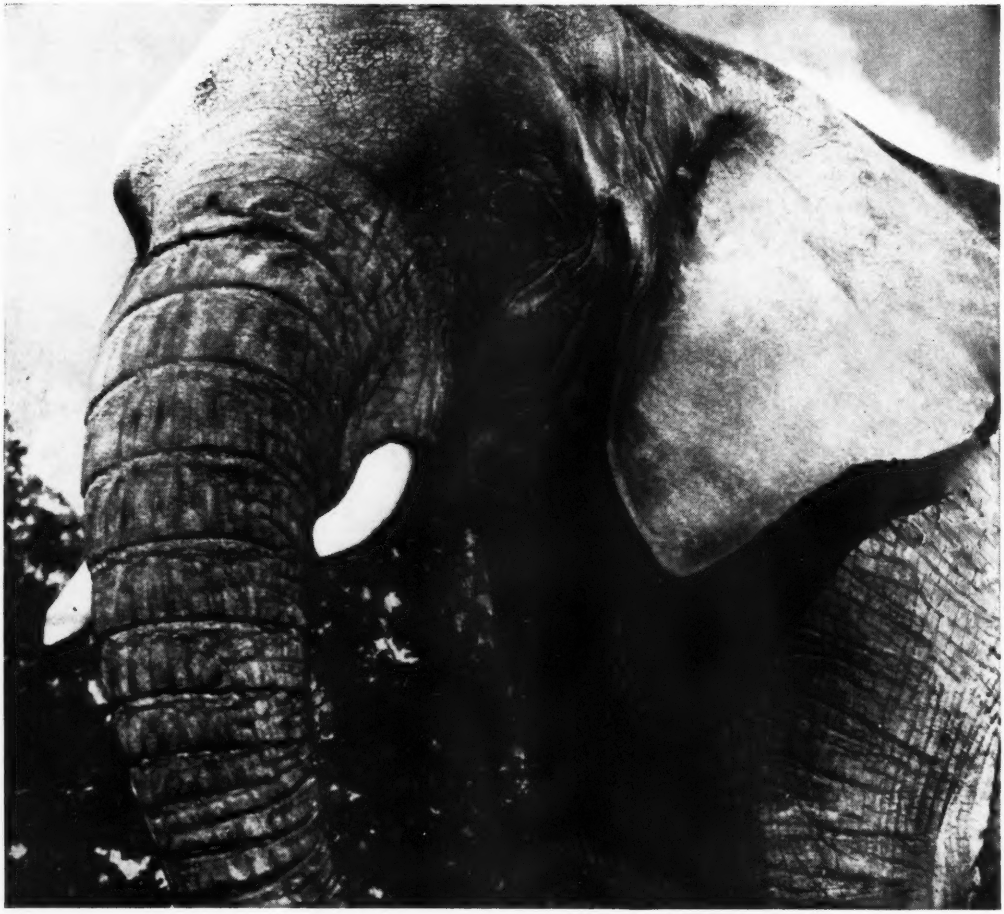
Guildford Surrey

PHONE: GUILDFORD 5214-7 TELEX: 8529 GRAMS: VULCANISED, GUILDFORD



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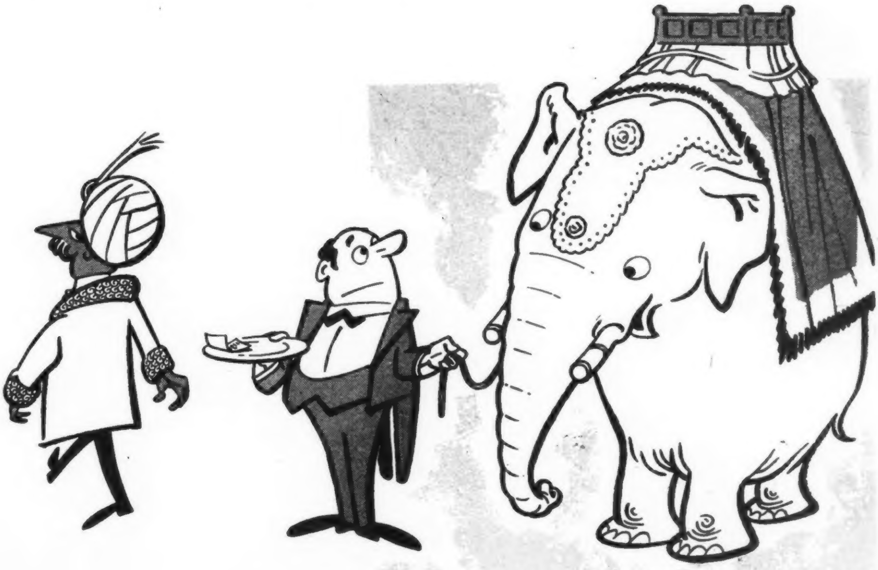

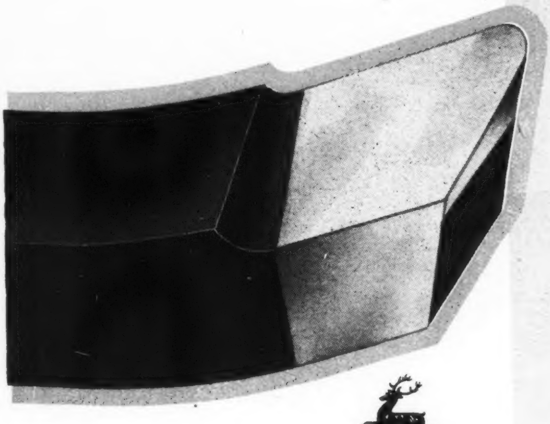

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With Stag Major Superweld cutting tools you get more than a tip. The cutting end of one of these tools is a good substantial piece of Stag Major high-speed steel, inseparably fuse-butt-welded to a high grade steel shank. For little more than the cost of redressing you get a complete solid tool hardened and ready for use on a lathe, shaper, planer, etc.
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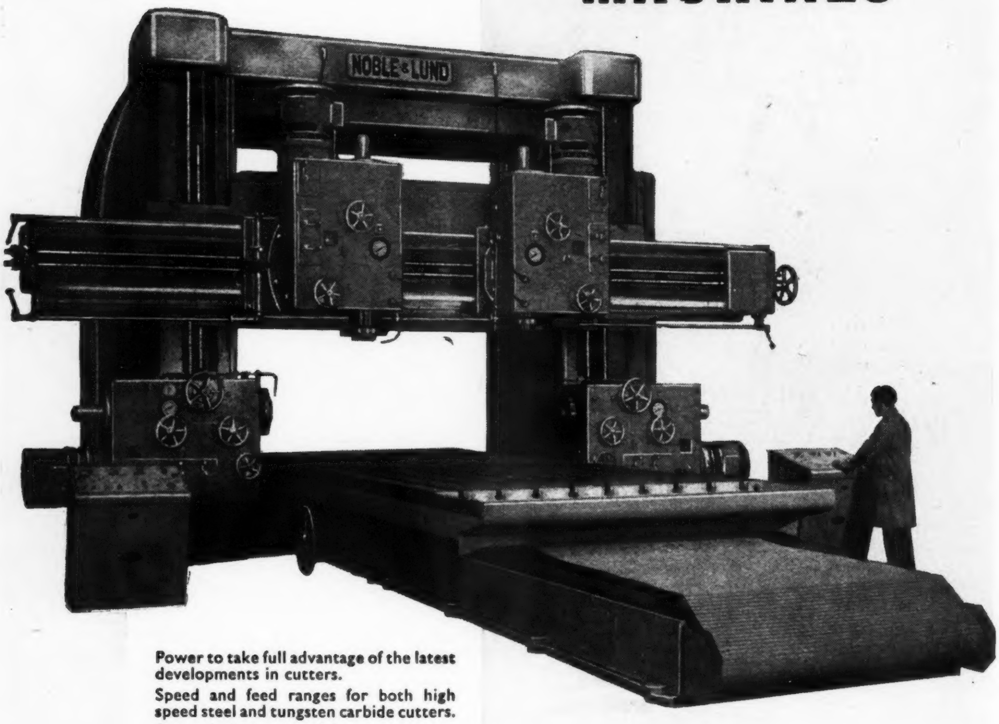

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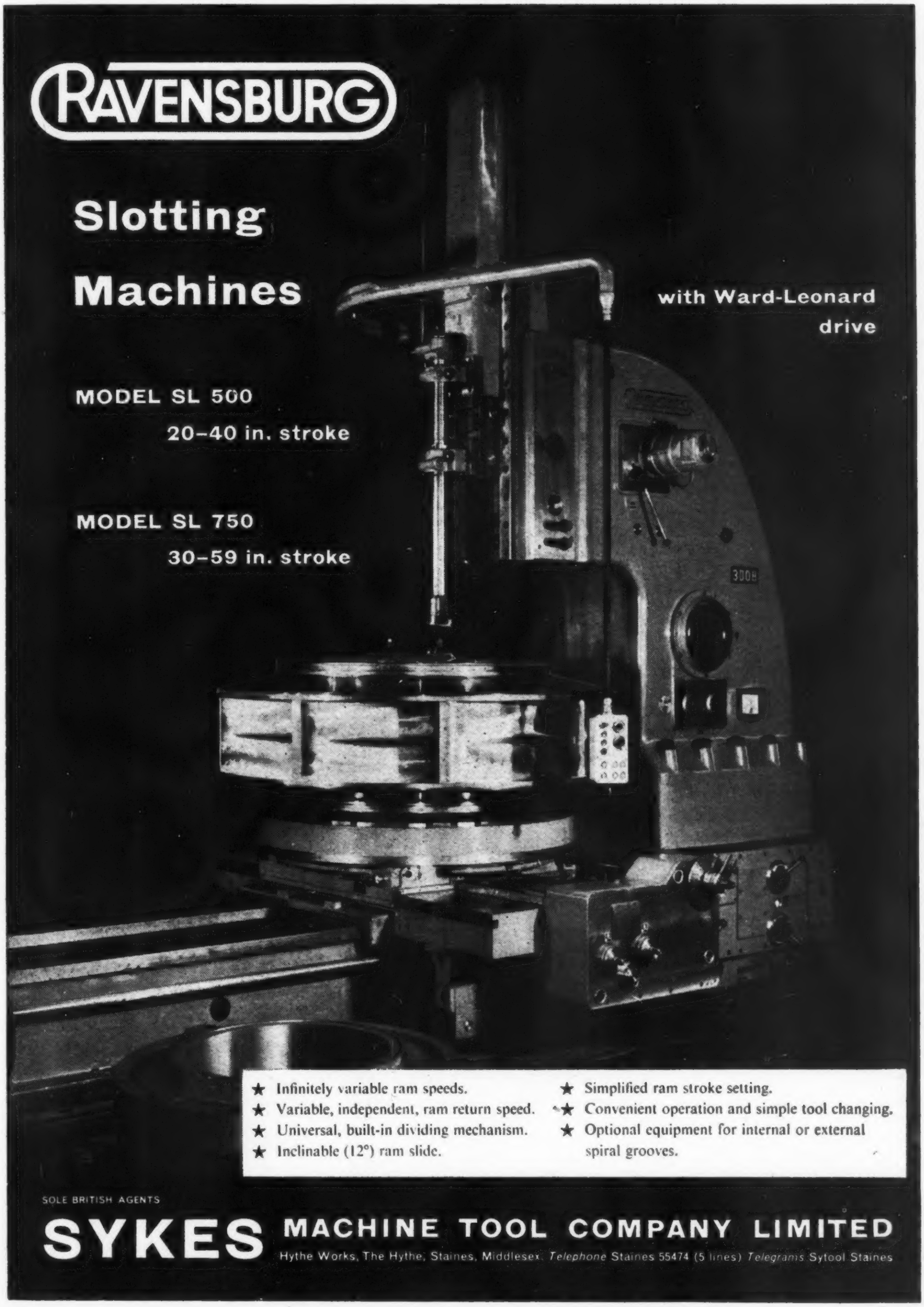
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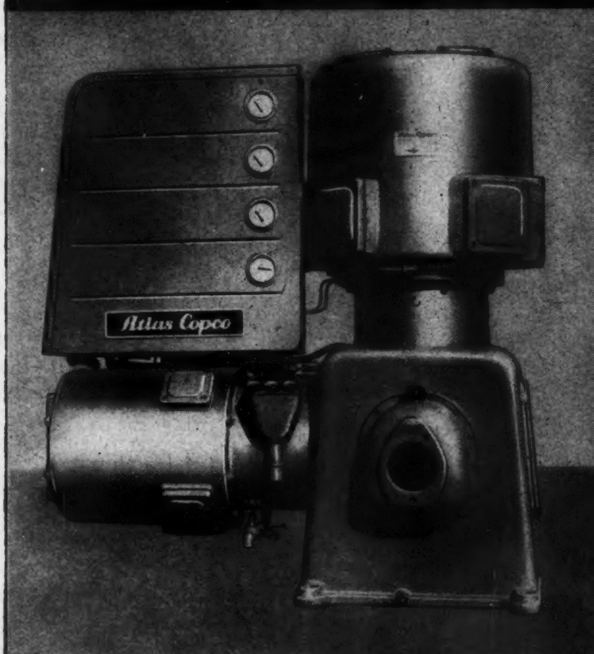

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. . . with the Atlas Copco ER6

The Skefko Ball Bearing Company Ltd., has recently installed its seventh Atlas Copco stationary compressor–an ER6. Designed to incorporate *every* economy factor, the ER6 delivers 1075 c.f.m. at 100 p.s.i. for the lowest possible cost. Here's where some of the economies occur:—

1. INSTALLATION The ER6 occupies about half the space usually required for 1000 c.f.m. machines–reduces expensive compressor house costs. A special base frame can be supplied to keep erection and alignment costs to the minimum.

2. POWER CONSUMPTION 10-15% lower than that of most comparable compressors. Taking the lower figure, and presuming 4,000 working hours per year, this can mean annual savings of up to £360.

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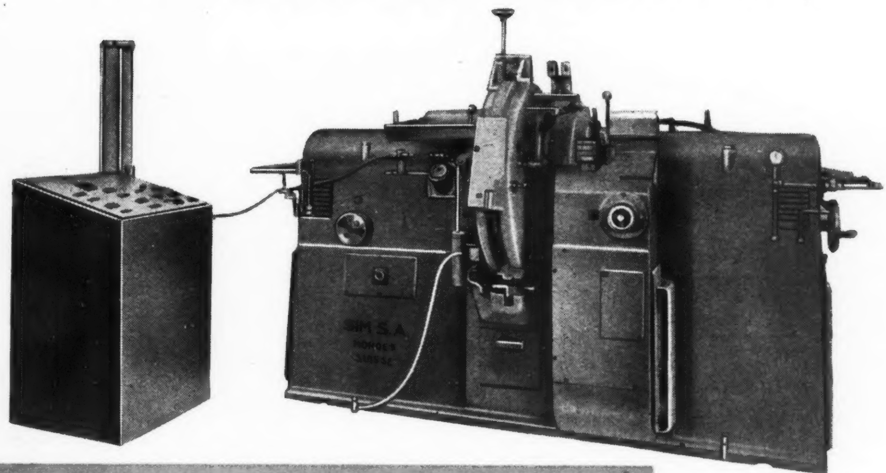
MODEL RRF 660

AUTOMATIC · ULTRA PRECISION DUPLEX GRINDING AND LAPPING MACHINE



The SIM ULTRA PRECISION Automatic Sizing Duplex Wheel Grinding Machine is designed to grind or lap cast iron or steel, roller or ring type components, where two parallel surfaces are to be ground simultaneously. The thickness may vary between $\frac{1}{16}$in.—$2\frac{3}{4}$in. and in diameter from $\frac{3}{8}$in.—$7\frac{1}{16}$in. The guaranteed working accuracy on thickness and parallelism may be controlled between ·00004in.—·00012in. on ring type components of up to 4in. diameter. On components of larger diameter the tolerance field lies between ·00004—·00016in.

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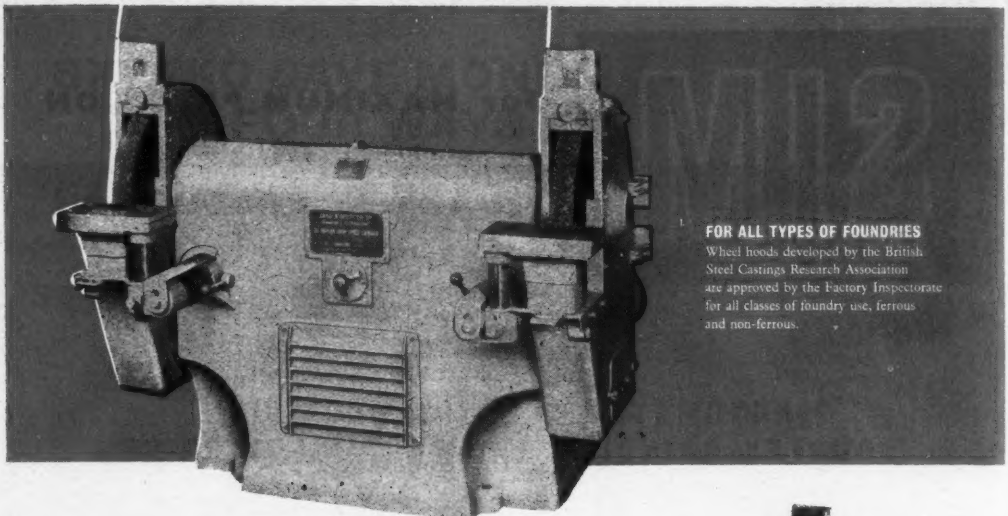
SOAG

SOAG MACHINE TOOLS LTD

JUXON STREET LAMBETH LONDON SE11 RELIANCE 7201



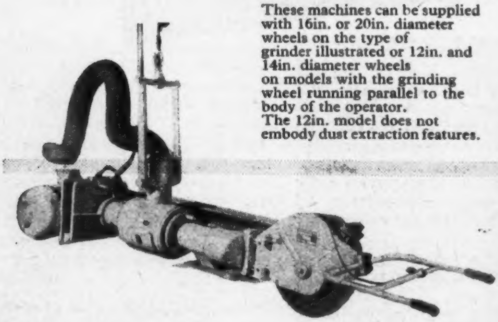
HIGH EFFICIENCY GRINDING COMBINED WITH HIGH EFFICIENCY DUST EXTRACTION

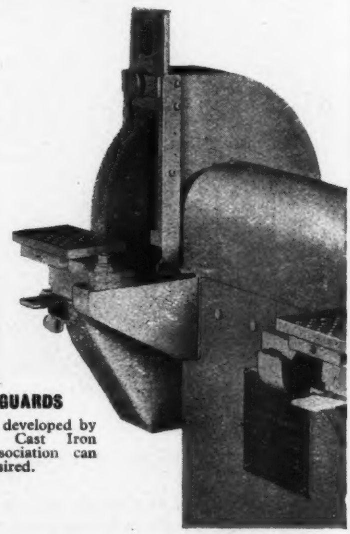
PEDESTAL GRINDERS

Luke & Spencer manufacture a large range of pedestal and swing frame grinders which incorporate the latest developments in efficient dust extraction.
Single or double ended pedestal grinders can be supplied with wheels ranging from 12 inches to 36 inches diameter.

SWING FRAME GRINDERS

These machines can be supplied with 16in. or 20in. diameter wheels on the type of grinder illustrated or 12in. and 14in. diameter wheels on models with the grinding wheel running parallel to the body of the operator.
The 12in. model does not embody dust extraction features.





B.S.C.R.A. GUARDS

Wheel hoods developed by the British Cast Iron Research Association can be fitted if desired.

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For High Speed and Normal Speed use. For Snagging and Precision grinding. We produce a full range of abrasive wheels under our trade names "Borolite", "Vitramic", "Lukspenite".
These cover resinoid, vitrified, rubber, shellac and silicate bonds.

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Wickman Scrivener

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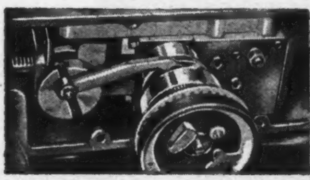
Here at last is the Surface Grinder you might have designed yourself. Incorporating in one machine all the features your operators have always wanted, it sets a new standard of machine design today, which will remain unsurpassed for many years in the future.

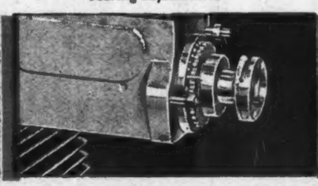
- ☆ Sturdy base, well-spaced slideways give ample support to saddle and table.
- ☆ Monoblock hydraulic valve assembly.
- ☆ Accessible large capacity power unit.
- ☆ Table speeds up to 125 f.p.m.
- ☆ Scrivener long-life wheelhead bearings.
- ☆ Large diameter nitralloy spindle.
- ☆ Adjustable spindle thrust bearing.
- ☆ Automatic lubrication of table-ways.
- ☆ Saddle, mounted in needle-roller anti-friction ways.

Brief Specification	618	824
Longitudinal Table Travel	20″	26½″
Transverse Movement of Saddle	7″	9½″
Vertical Movement of Wheelhead	11½″	11″
Height from Table under new wheel	10″	10″
Table Working Surface	6″ x 18″	8″ x 24″
Table — Hydraulic Power Traverse	125 fpm	90 fpm

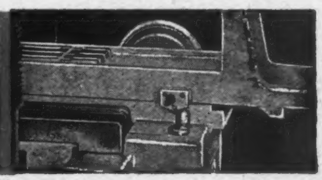
Monobloc Assembly



Spindle and thrust bearing adjustment.



Automatic Lubrication



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FACTORED MACHINE TOOL DIVISION, BANNER LANE, COVENTRY

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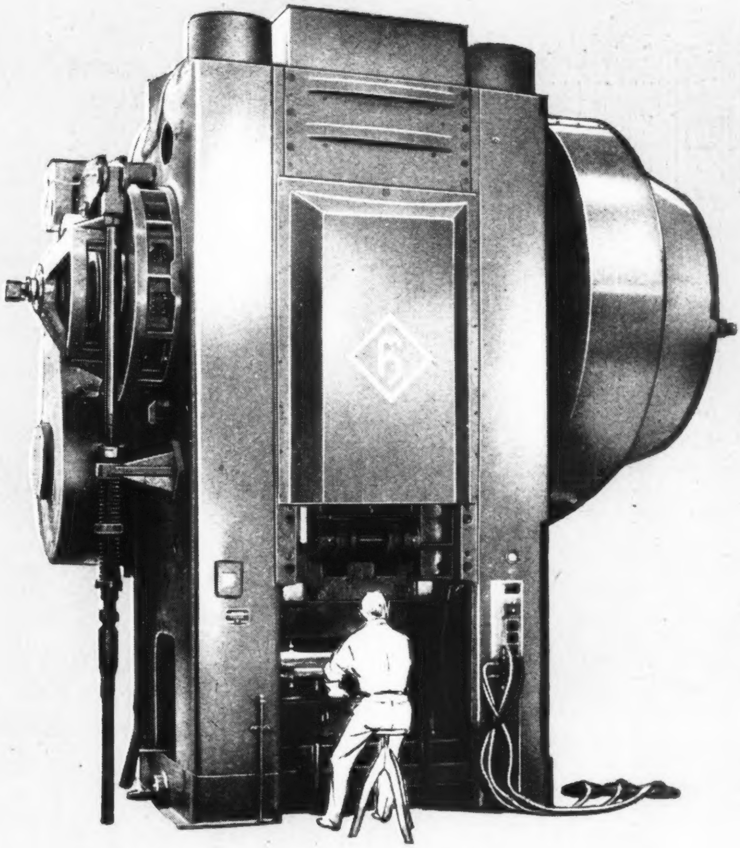

HASENCLEVER Eccentric Forging Presses

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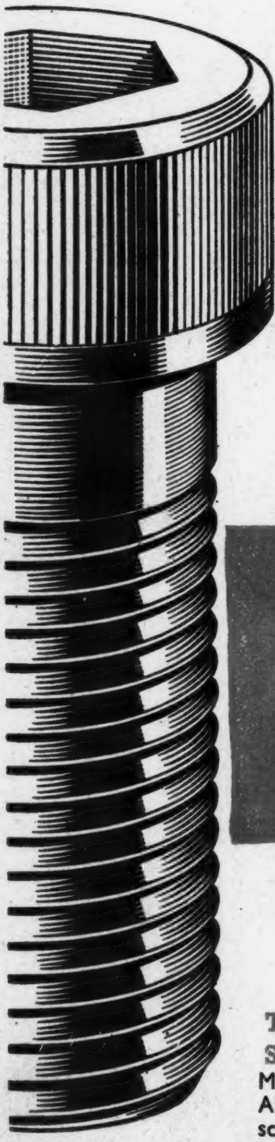
PAUL



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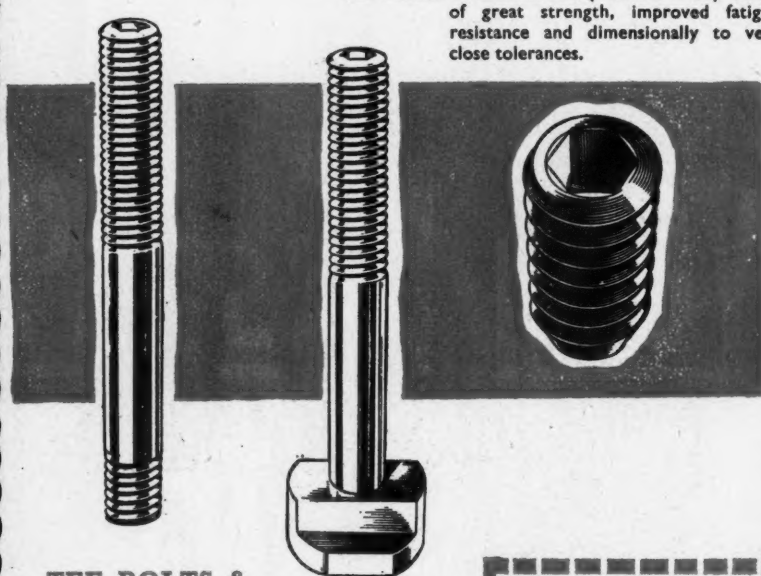
SOCKET SET SCREWS · SOCKET CAP SCREWS
TEE BOLTS AND SOCKET STUDS

SET SCREWS: Manufactured to close tolerances from Chromium Molybdenum Alloy Steel hardened and tempered to ultimate tensile strength 100 tons/sq. in. with adequate elongation and impact properties and conform to the requirements of B.S. 2470—1954.

SOCKET CAP SCREWS: Made from Nickel Chromium Alloy Steel and completely Cold Forged. Hardened and tempered to ultimate tensile strength of 80/90 tons per square inch again conforming to B.S. 2470—1954.

This method of manufacture produces a Cap Screw of great strength, improved fatigue resistance and dimensionally to very close tolerances.



TEE BOLTS & SOCKET STUDS:
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ME Universal Ball Joints are recognised throughout industry as the best obtainable. Precision engineering and the use of high quality (Air Board approved) material ensure the constant reliability of all types and sizes of joint.

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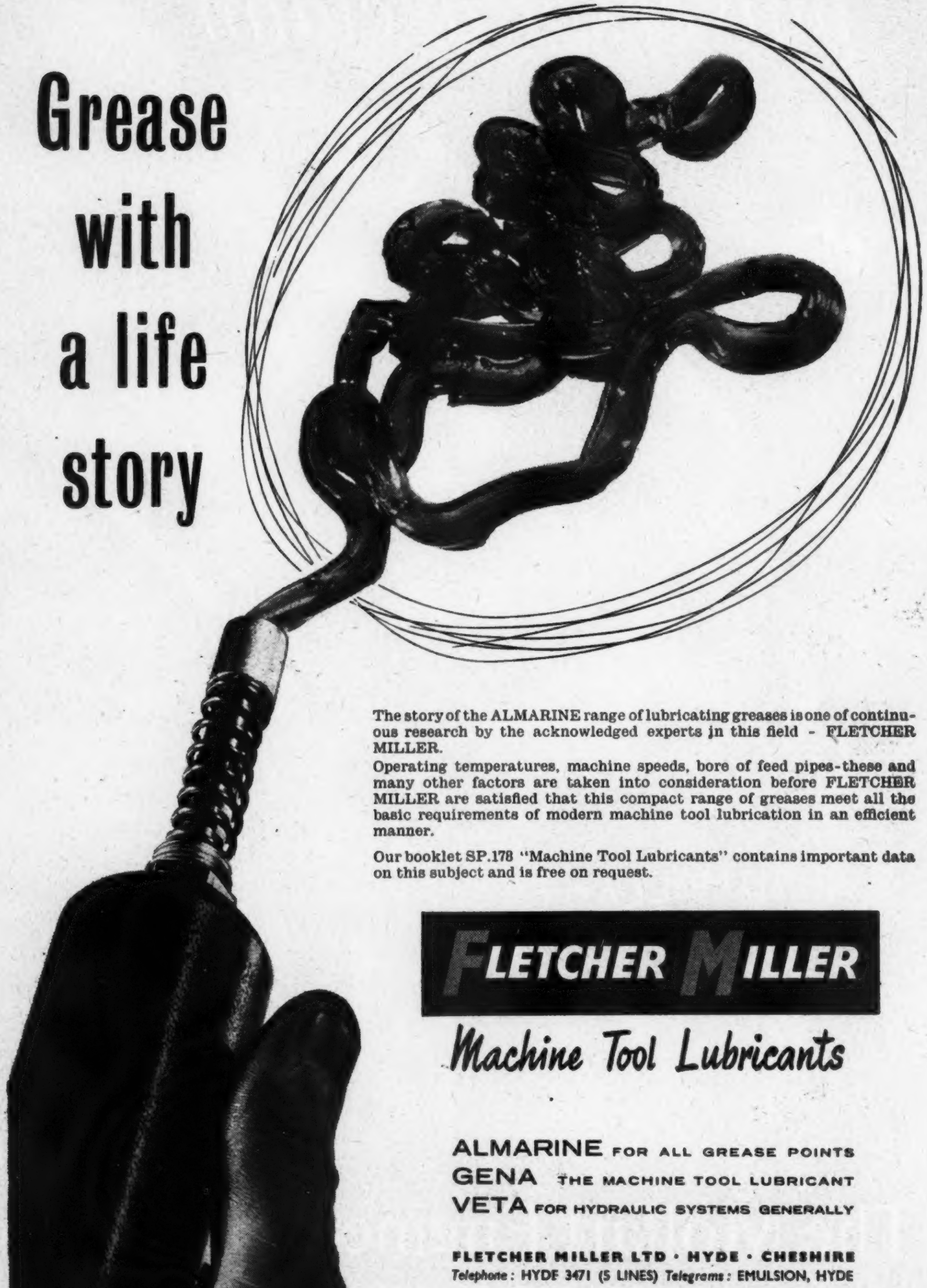

The story of the ALMARINE range of lubricating greases is one of continuous research by the acknowledged experts in this field - FLETCHER MILLER.

Operating temperatures, machine speeds, bore of feed pipes-these and many other factors are taken into consideration before FLETCHER MILLER are satisfied that this compact range of greases meet all the basic requirements of modern machine tool lubrication in an efficient manner.

Our booklet SP.178 "Machine Tool Lubricants" contains important data on this subject and is free on request.

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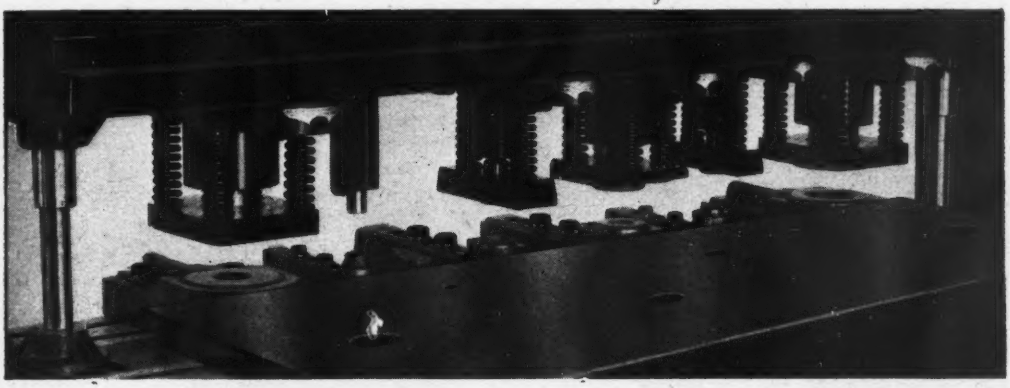
A NEW DEVELOPMENT IN THROUGH PIERCING

Incorporating the **HIGH STRIPPING** qualities and comparable capacities of Unipierce Tooling, and capable of being used alone or in conjunction with Standard Units. It also lends itself to automatic feed.

Component Setting is by Standard Redman Template in bottom bolster, by Master Template, or by linear measurement. While Punch and Die Setting is by positive Punch to Die, or by size plug to die, obviating the nipping of punches.



THE NEW UNIVERSAL

The life and accuracy of Punches, Dies and Strippers are known to users throughout the country.

Despite the obvious advantages of Unipierce Tooling, throat dimensions sometimes limits capacity.

Universal tooling is then the answer.

Castings are sturdy and streamlined and the Units themselves are backed by a Design Team having the greatest experience in **UNIT TOOLING** available in Great Britain today, while ancillary parts are up to the high standard already in use.

Our representative will call and show you a sample set-up and demonst-ate the setting on request.

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Tel: Worcester 26933 (4 lines) Grams: Redtools, Worcester.

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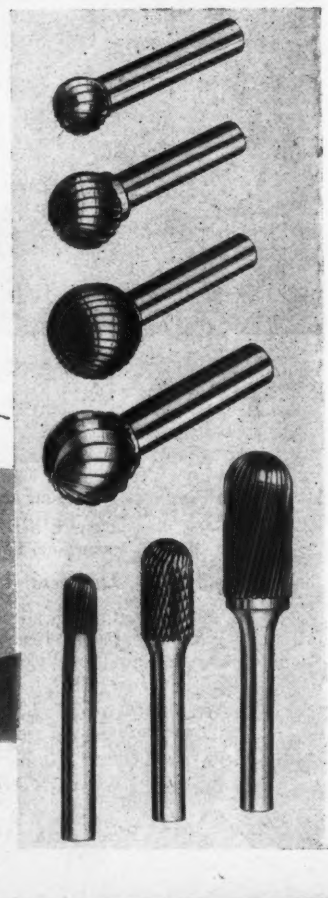

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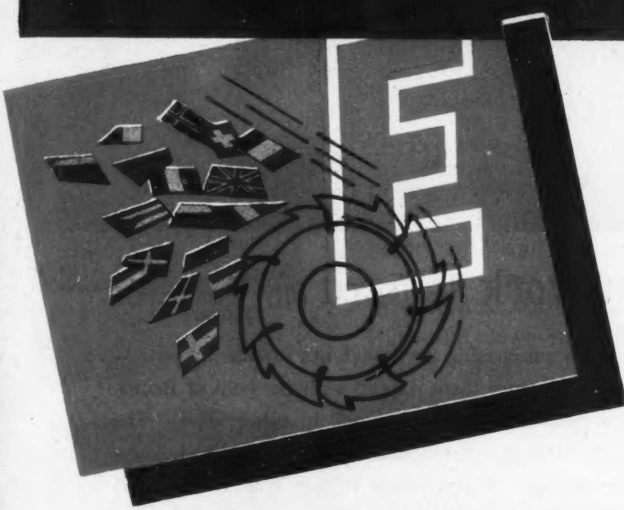

The illustration shows the Houghton Industrial Oil and Lubrication Service Station at the Brussels Exhibition, from which all Vaughan products were supplied.

In conjunction with HOUGHTON European Countries, no less than 184 Machine Tools exhibited at Brussels last September, were lubricated with HOUGHTON Metal-working Oils, Coolants, etc.

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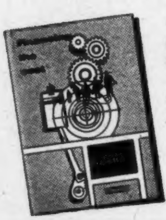

Our leaflet 'Financing the Cost' gives you full details of how the British Wagon Finance Plan can help you. Let us send you a copy.

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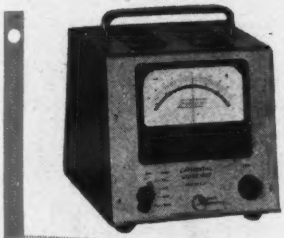

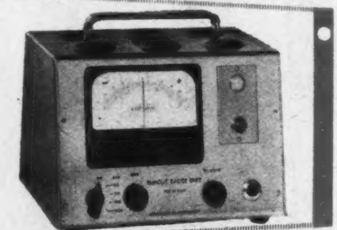

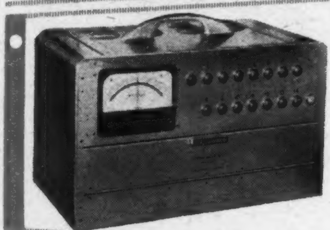

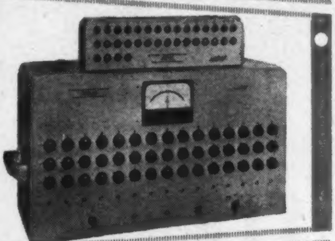

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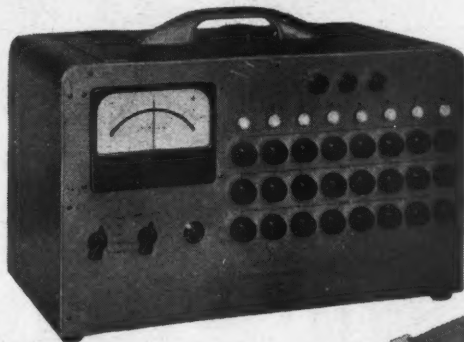

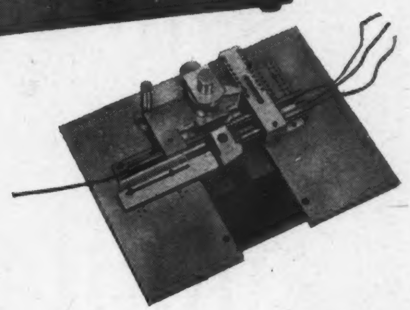

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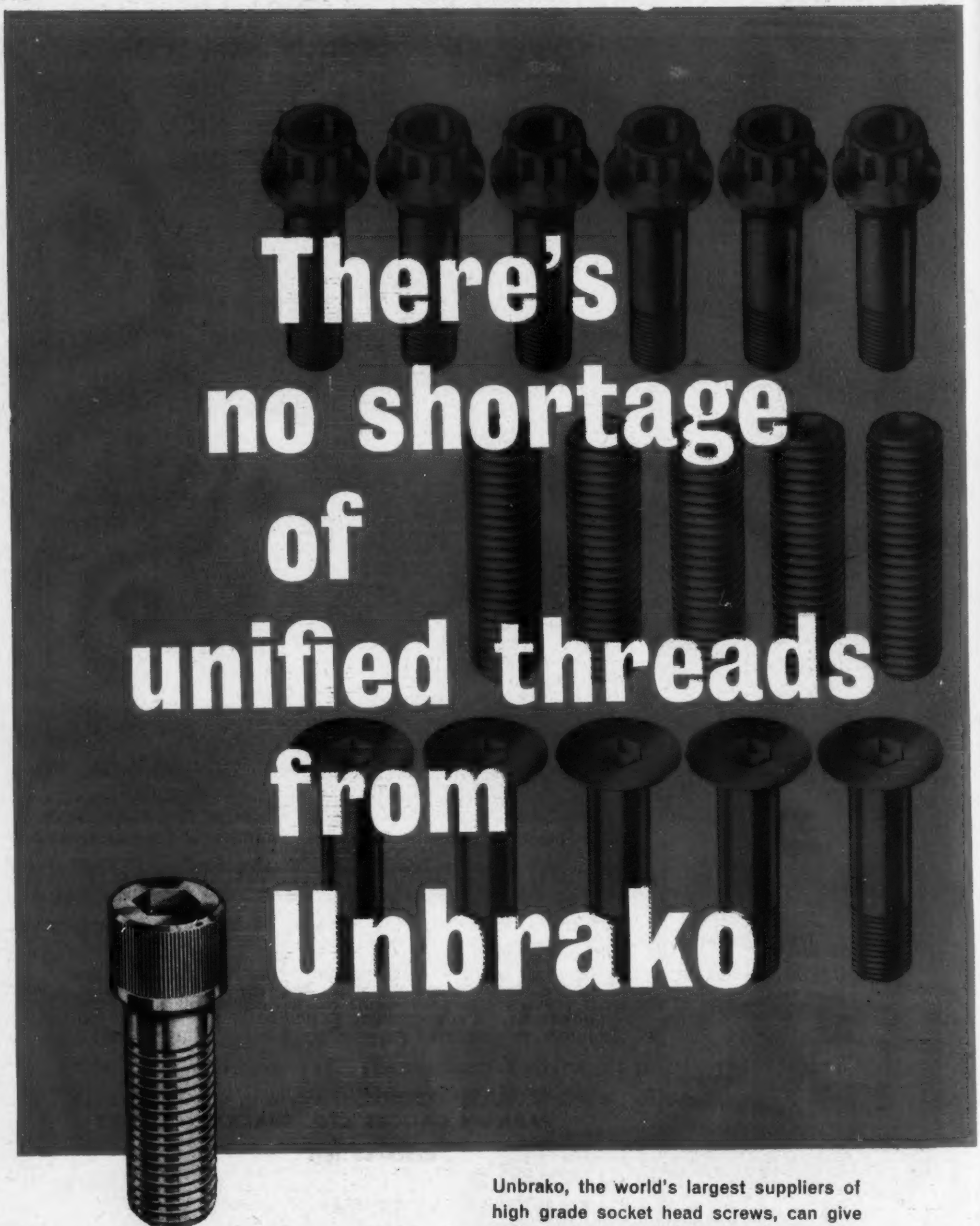

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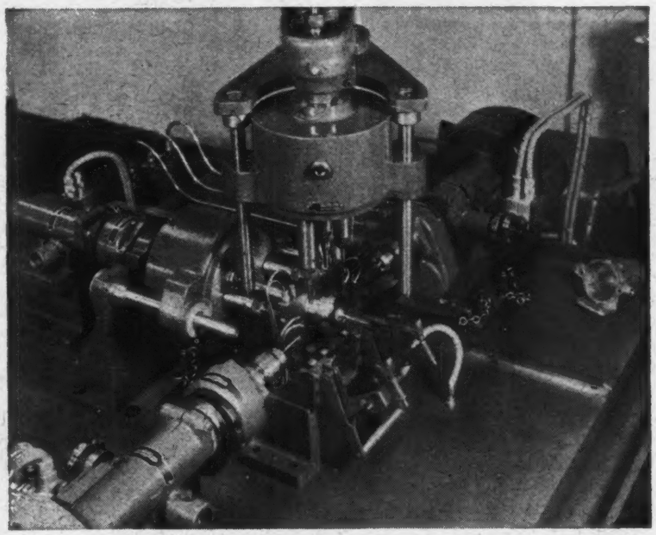
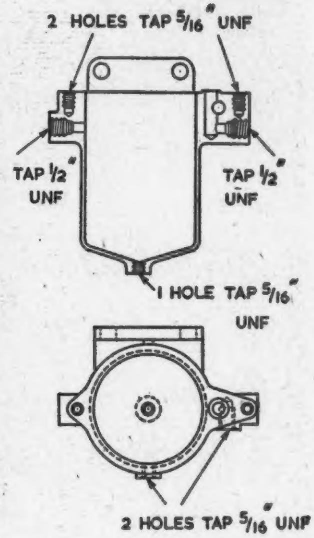
MEDDINGS Pacera

TECHNICAL NEWSHEET

ITEM	Filter body
OPERATION	Tap all seven holes





The component illustrated at the right is an aluminium alloy Fuel Oil Filter Body. We designed and manufactured two machines for the drilling and tapping of this component. The drilling, countersinking and facing of the two opposed ½" UNF holes is carried out on a machine with two opposed Unit Heads. The 8-spindle tapping machine now described is for tapping the five 5/16" UNF cored holes and the two ½" UNF holes previously drilled. It should be noted that the vertical head is fitted with a 3-spindle attachment in order that both left-hand and right-hand components can be tapped by loading in two alternative opposed positions. In this manner no time is wasted in setting up for either component. In operation a previously drilled component is manually loaded into the fixture and clamped. On depression of the Start Button all spindles advance and tap 7 holes, after which the component is manually unloaded. The workholding fixture is simple and efficient in operation and comprises a central spring-loaded spigot, the component being held in position by a toggle clamp. The machine is largely constructed of standard equipment and comprises 4 pitch-controlled Tapping Heads, two of which are fitted with geared type fixed centre multi-spindle Tapping Heads.
We design and build special-purpose rotary or in-line transfer machines for drilling and tapping.

W. J. MEDDINGS LTD.

SPECIAL PURPOSE DIVISION

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The Alcedo Ispida is Efficient But hardly a

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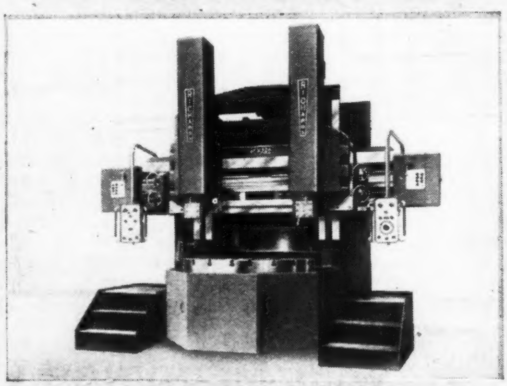
HORIZONTAL and VERTICAL BORERS produced by GEORGE RICHARDS & CO. LTD., however are unsurpassed for precision speed and adaptability. Continuous research and development keep RICHARDS borers way ahead of all others.

Illustrated right is a RICHARDS VERTICAL BORING MILL, supplied in a range with table capacities from 5ft. to 10ft., with or without side-head. The complete range of machines includes table capacites up to 50ft.



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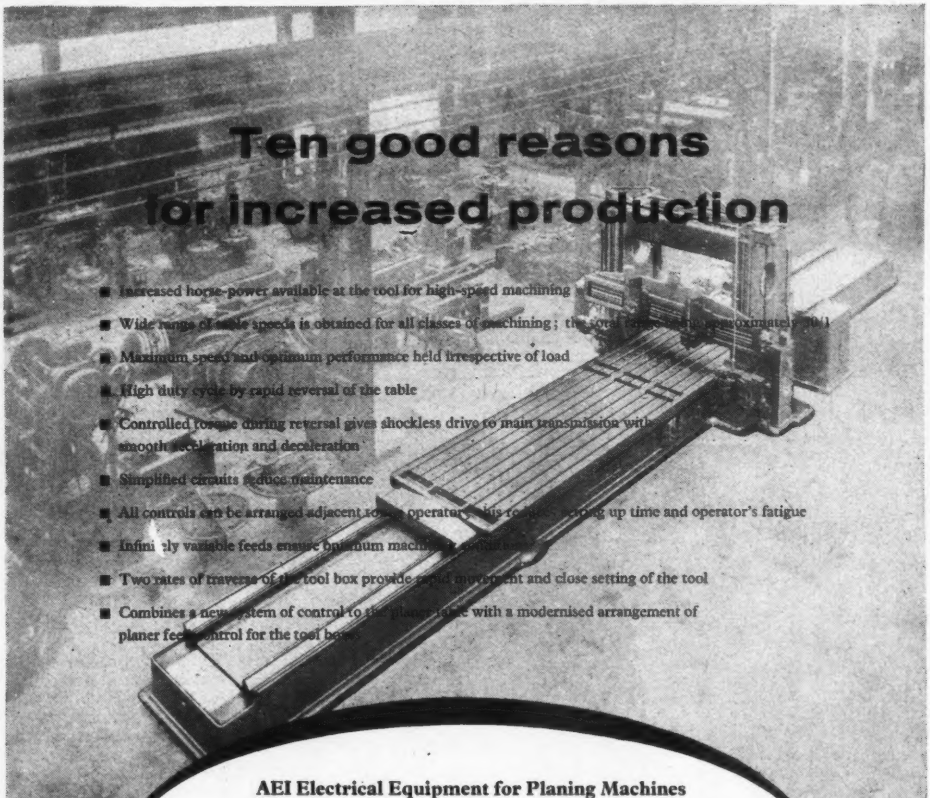

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A closed loop system, incorporating a magnetic amplifier of the flux resetting type, controls the variable voltage main reversing motor.

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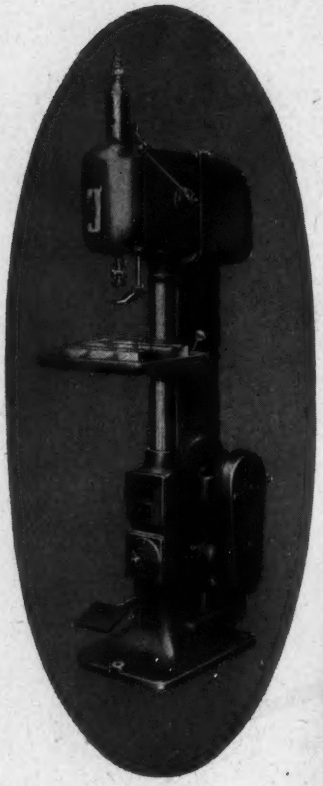
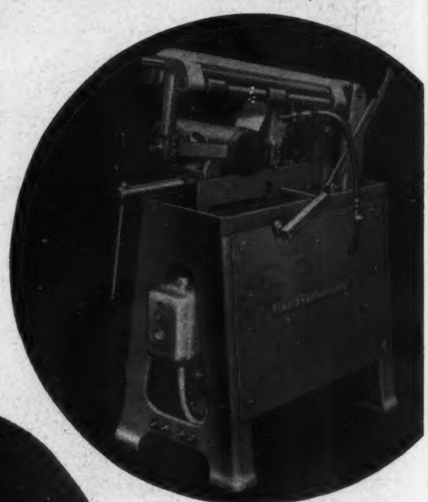
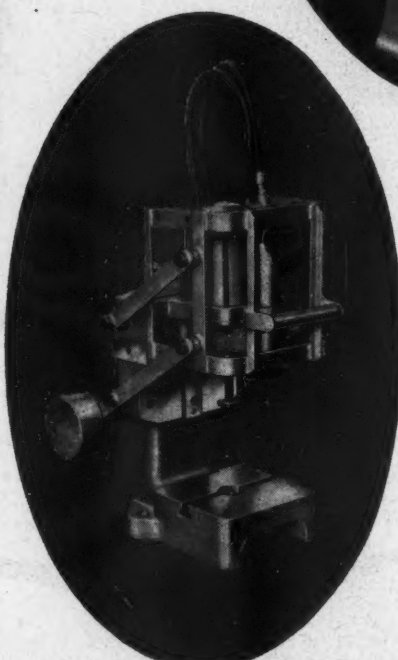


MODEL 603
TAPPING MACHINE

This machine has been designed for tapping holes up to $\frac{5}{16}$in. Whit., in mild steel. Three rates of tapping speeds are provided and the feed to the spindle can be operated by hand lever or pedal having independent controls. The extreme ease and simplicity of the controls enable holes to be tapped on a production basis.





4in. HACKSAW MACHINE
with Hydraulic Relief

Designed for use where its small size and portability are of advantage, i.e., in the many departments of large works where a small machine on the spot saves time, and also for Small Workshops Stores, Laboratories, Experimental Depts., Schools, etc. The Machine has a stroke of 150 per minute and a capacity of 4in. at 90°.

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This is a recent introduction to the range of J & S Hand Presses. The Model 1795 is air operated having a 3in. stroke of 100 P.S.I. giving a ram thrust of 1,317 lbs. approx. The ram is bored $\frac{1}{2}$in. $\pm$ ·00025 diameter and the work table has a standard $\frac{1}{2}$in. tee slot and a centre hole 1 $\frac{11}{16}$in. diameter.

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Write for full details and price list.

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MAKERS OF BRITAIN'S WIDEST RANGE OF ELECTRICAL CONTROLS AND ASSOCIATED EQUIPMENT

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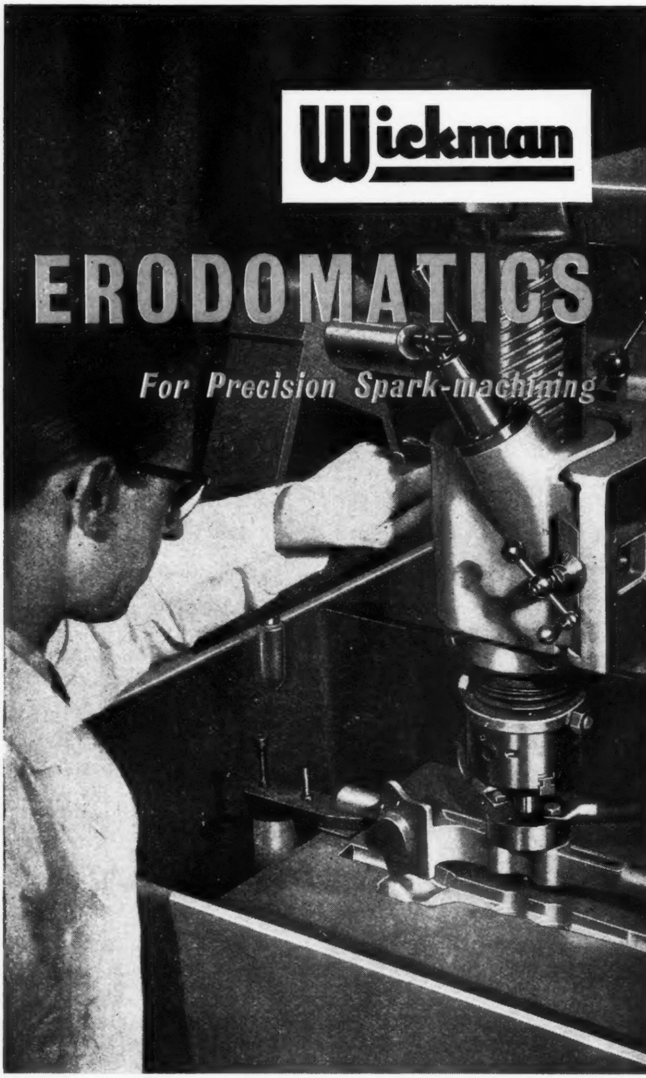
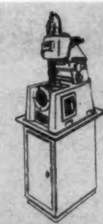
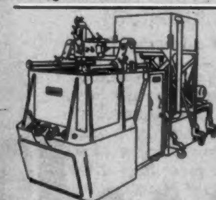


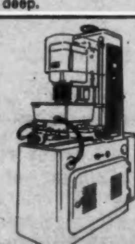


TYPE W/BM. 1.5 kVA.
The smallest unit in the Erodomatic range. Suitable for tool-room or production use for small precision work.

TYPE W/SM. 4.5 kVA.
Especially designed for production work. Large work-tank accommodates wide range of work.



TYPE W/DM. 4.5 kVA.
The largest machine in the range. Designed for die production with capacity of 26 in. long x 16 in. wide x 15 in. deep.



The CHARMILLES ELERODA D.1.
Designed for high-precision tool-room work.

The equipment in the Wickman Erodomatic range covers both toolmaking and production fields. If you would like to learn more about the process and its scope, send for the brochure illustrating some recent production examples.

WICKMAN LIMITED

ELECTRO-MECHANICAL DEPARTMENT, UPPER YORK STREET, COVENTRY, ENGLAND. Telephone: Coventry 28494

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The Automatic Grinding of Ball-bearing Races .. .. P. 1116

The Hoffmann Manufacturing Co., Ltd., Chelmsford, Essex, have recently installed high-capacity plant for the complete grinding of ball-bearing inner and outer races for some 30 different sizes of bearings, with bore diameters of ⅜ in. to 1½ in. and 15 mm. to 50 mm. In the main grinding section, 41 automatic machines are employed for grinding the bores and tracks of inner races, and track-grinding and honing outer races. These machines, which comprise seven Bryant Centalign, four Heald 190A, ten Landis, ten Heald 1901 Centrimatic, and ten Hoffmann, are served by automatic feed equipment, and are arranged to run continuously, night and day, five days a week. The entire section is served by four machine-minders, four setters and one "trouble-shooter" per shift, and the floor area which is occupied affords a capacity approximately equivalent to one third of that originally required when the components were made by earlier methods. All services are centralized, and the main coolant supply and clarification system is capable of handling rates of flow up to 400 gal. per min. Typical set-ups on the Bryant and Heald machines for bore grinding inner races, and the associated "post-gauging" and "in-process" systems of automatic feed-back size-control, are described. (MACHINERY, 99—15/11/61.)

A.M.T. Unit Head Machines .. P. 1126

Two unit head machines have been supplied recently to Vauxhall Motors, Ltd., Luton, by A.M.T. (B'ham) Ltd., for operations on components for motor car oil pumps. One machine performs drilling operations on the body of the pump, and the other is designed to mill the joint face, also an oil relief slot, on cover components. The latter machine has a 36-in. diameter indexing table, and the work-holding fixtures are mounted in pairs around the periphery. (MACHINERY, 99—15/11/61.)

Some Typical Applications of Induction Heating .. .. P. 1129

Heating by induction is a versatile process, and lends itself readily to automated set-ups. The amount of heat applied can be regulated accurately, also controlled simply, and can often be employed for dual purposes, for example, combined brazing and hardening. Examples of typical applications described in this article include: induction case-hardening gudgeon pins; brazing carbide tips to circular saws, and subsequently hardening and tempering the teeth; soldering and unsoldering thin gauge instrument cases; and brazing fittings to fuel pipes for aircraft and missiles. (MACHINERY, 99—15/11/61.)

Thielenhaus Microfinish Superfinishing Machines .. .. P. 1138

Crankpins and journals on multi-throw crankshafts can be superfinished simultaneously on the type KW. 3 machine built by the German firm of Thielenhaus. The machine can be supplied with length capacities of 40, 60, and 80 in., and the superfinishing heads can be adjusted independently for centre distance, so that the set-up can be readily changed for handling different crankshafts. A 4-spindle machine is available for superfinishing raceways for ball and roller bearings. Magazine-type work-loading equipment is provided, and the machine can be operated on a semi-automatic or a fully-automatic cycle. (MACHINERY, 99—15/11/61.)

Producing Components for Box-making Machines .. .. P. 1143

At the Crayford works of Vickers-Armstrongs (Engineers), Ltd., the bores of drive pulleys for Empire wire-stitching machines are finished by rolling. A Rodo tool is employed, which is mounted in the turret of a Ward No. 7 lathe. The bore of each pulley is rolled to 2 in. diameter, +0·001, −0 in., and about 350 pulleys have been finished without adjustment of the tool. Many components for the company's box-making equipment are finished by the Almco Supersheen process. Apart from general polishing and burr removal, before or after hardening, the process is used to remove excess Araldite, now employed to secure smaller components to formers, in place of riveting. (MACHINERY, 99—15/11/61.)

Berardi Special-purpose Machine Tools P. 1150

Officine Rino Berardi, Brescia, Italy, has been in operation for some 30 years, and its products include a wide range of special-purpose high production machine tools for performing milling, facing, boring, drilling and tapping operations. This article gives details of the various ranges and sizes of unit heads built by the company, also some typical examples of different types of special-purpose machines that have been built. (MACHINERY, 99—15/11/61.)

Index to Exhibits at the 7th European Machine Tool Exhibition Described on pages 1153—1158 of this Issue

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

The Company Research Department

With the growing appreciation of the importance of research and development activities, research departments are being formed by many companies engaged in various branches of engineering, apart from the expansion in the number and scale of operation of the research associations and the Government-sponsored research establishments. Collectively, the increasing volume of research work that is being undertaken makes heavy demands on scientific and technical manpower, of which there is at present a serious scarcity, and while it is generally agreed that if we are to retain our industrial position in the world recruitment for research must have priority, it is also essential to ensure, as far as possible, that the work of scientists and technologists in this field is not being squandered.

In his presidential address to the Institution of Mechanical Engineers, Sir Kenneth Hague, LL.D., was concerned with the general problems of co-ordinating research in order that duplication of effort may be avoided. With the multiplication of company research departments within a given section of industry, the possibilities of duplication of work are obviously increased, and since it is the primary purpose of such a department to further the commercial interests of the associated company, the scope for co-ordination is obviously considerably restricted. In these circumstances, it is the more important that the individual research department, within its terms of reference, should operate as efficiently as possible, and in the section of his paper which was concerned with this aspect of research, Sir Kenneth had some very significant recommendations to make.

In particular, he pointed out, it is not sufficient to engage an able scientist with good academic qualifications, provide him with adequate facilities as regards staff, buildings, and equipment, and then leave him to his own devices. By reason of his training and outlook, such a man may have very definite ideas as regards the kind of work that he would like to carry out, and although he may produce results that are important in themselves, it does not follow that they will be of any particular value for improving the company's products or methods of manufacture. If such a situation arises, despite initial enthusiasm on the part of the board of directors, the research department may come to be regarded as a failure, and the whole project may be abandoned.

A research director or manager, it is suggested, "should have a sound background knowledge of the working of the company, and be accepted by the management and by his colleagues at equivalent level as an important and responsible member of the organization." Moreover, he should have the sympathetic help of a small committee consisting of chief executives who, by their functions and their experience, are able to give advice as to the type of research work which should be carried out. Such advice is necessary because current developments in the section of industry in which the company is engaged "may well require the abandonment of certain research work already undertaken, or conversely, the addition of urgent *ad hoc* work on a new problem."

Sir Kenneth went on to recommend that in addition to submitting a research programme to his committee, a research director or manager must be capable of producing a comprehensive annual report of the work carried out, to enable the board and management to assess the value of the research department to the organization and ascertain whether it is functioning on the right lines. Unless research administration is adequate "it is almost inevitable that unnecessary work will be undertaken, some of which may be carried on for years, resulting in waste of trained scientific manpower and financial resources."

It is also important that the research director should be able to take part in the activities of the research associations and other scientific bodies with which his company is connected, "and interpret fully the research policy of his company thereto." At the same time, it must be recognized that at the level of company research, it is inevitable that any invention or idea that appears to be new, " but may be new only to the thinker or research worker," will be developed secretly, in order that it can be ascertained whether or not commercial advantage can be gained.

In this connection, also, Sir Kenneth had some advice to offer. "The days when a new idea, on which much time and energy had been spent, could be patented, with the comfortable feeling on the part of the patentee that his work was protected, for at least a period which would enable him to use it exclusively to his own advantage, are largely over. As a result, it is often preferable to develop a new idea and put it into practice without herald-

(*Continued on page* 1170)

The Automatic Grinding of Ball-bearing Races

High-capacity Plant at the Works of the Hoffmann Manufacturing Co., Ltd.

By S. C. POULSEN, Associate Editor

SINCE AN EARLIER SERIES of articles was published in MACHINERY, describing typical examples of the methods employed for producing their extensive range of ball and roller bearings, the Hoffmann Manufacturing Co., Ltd., Chelmsford, Essex, have installed high-capacity plant for what is termed their "O" line, which provides for the complete processing of ball-bearing inner and outer races, following the heat-treatment stage. This line has been installed to meet an ever increasing demand for the firm's products, and after a period of development when it was run on a pilot basis, has now been in operation for approximately 12 months. Situated in their No. 1 factory, it is devoted to the production of races for bearings of some 30 different sizes, with bore-diameters of ⅝ in. to 1½ in., and 15 mm. to 50 mm. Moreover, a slightly wider range of sizes can, if necessary, be accommodated.

The main section of the line is shown diagrammatically in Fig. 1, and comprises 41 automatic machines, arranged in two lines on each side of a central gangway. One pair of these machine-lines is employed for inner race bore and track grinding, and the other for outer race track grinding and honing. To provide the necessary capacity, the section is arranged to operate continuously for 24 hours a day, 5 days a week, and during these periods, the machines are only stopped for brief intervals, as required for normal routine attention, such as wheel replacement, tooling changes, and minor adjustments by the setters. On this basis, the line is capable of handling a major proportion of the output of the very extensive automatics section of the No. 1 factory (see MACHINERY, 91/666—20/9/57) which includes 13 recently-installed Conomatic machines. Furthermore, it affords a capacity which is approximately equal to that originally available from a floor area roughly three times the present size by means of earlier methods (see also MACHINERY, 91/1017—7/11/57). Each machine line is tended by one machine-minder and one setter per shift, during which the entire section is also served by a "trouble-shooter."

The line for the bore grinding of inner races comprises seven Bryant Centalign machines *A*, Fig. 1 (Buck & Hickman, Ltd.) and four Heald 190A Centrimatic machines *B* (Alfred Herbert, Ltd.). In the adjoining line there are ten Landis machines *C*, for track grinding inner races, which are of the 4-in. Concentric type (Landis Lund, Ltd.) and on the opposite side of the central gangway, there is a line of ten Heald type 1901 Centrimatic machines *D*, engaged on track grinding outer races. Honing of the outer race tracks is performed in the line *E*, which comprises ten special-purpose HMC machines, and the corresponding operation on the inner race tracks is carried out in another section, also on HMC special-purpose machines. These latter machines, it may be noted, were described in MACHINERY, 91/1024—1/11/57, in which reference was also made to the "pendulum" method of lapping outer race tracks, now superseded by the HMC machines mentioned above.

CENTRALIZED SERVICES

Because of the large number of machines, and the exceptional demands imposed by the operating conditions, all services for the supply of hydraulic fluid, coolant, cooling-water and electric power are centralized. The capacity and arrangement of these services, and of the associated equipment for processing, storage and distribution, necessitated the most careful study, based on the experience gained with the pilot plant. Among the many interrelated factors that had to be taken into account were economy of floor-space; the influence of temperature-rise on machine accuracy over long periods of continuous operation; adequate facilities for coolant clarification and dissipation of heat; the necessity for different coolants for different operations and sizes of work; the provision of standby facilities, to avoid the necessity for shutting-down entire sections of the line in the event of a supply failure; and the avoidance of corrosion resulting from the use of town mains water for the cooling of certain items of equipment.

All liquids are delivered to the machines by a system of overhead pipelines, and coolant from the main supply is returned to the processing plant through channels in the shop floor. The centralized hydraulic fluid supply, which is required for the Landis machines only, is drawn from a 200-gallon tank *F*, Fig. 1. Fluid is delivered to the machine lines by a Racine type 8R pump, powered by a 20-h.p. motor, which has a maximum output of 50 gal. per min. at 1,000 lb. per sq. in pressure. Associated with this pump, there is a Serck heat-exchanger, cooled with water drawn from the nearby river Chelmer, with town mains water as an alternative supply for emergency use. A second identical pump, motor and heat-exchanger are provided for standby purposes. Hydraulic fluid that leaks from the machines is returned by gravity to an auxiliary tank, provided with a separate pump and float-operated switch, whence it is periodically fed back into the main tank.

The wheel-head motors of the Bryant machines are water cooled, and river-water is again employed in preference to town mains water, in order to minimize corrosion. Town water is, however, used as a standby supply. The softened river-water, which is treated with corrosion-inhibiting additives, is drawn from a 180-gal. sump beneath the shop floor, and is cooled by means of a Serck heat-exchanger fed with untreated river-water. Water is used for cooling the wheel-heads, instead of the more customary soluble-oil solution, to ensure maximum cooling effect in view of the long periods of continuous operation.

COOLANT SUPPLY

The coolant system provides for the supply of three different media, namely, Vaughan's Evco 523 sulphurized oil, which is used for the majority of the grinding operations; Vaughan's Hocut CM high-dilution soluble-oil emulsion, with anti-foaming and anti-corrosion additives, for grinding large-diameter work in which thermal effects must be counteracted to ensure accurate dimensional control; and Fletcher Miller's Swift H honing fluid. Soluble-oil emulsion is drawn from a 200-gallon sump (*G*, Fig. 1) beneath the shop floor, and it is delivered to the machines by a Mather & Platt Solovane pump with a capacity of 200 gal. per min. A second identical pump is provided as a standby. Soluble oil emulsion is returned to the sump by gravity, by way of channels in the shop floor, and passes through a Barnesdril combination cloth and magnetic filter unit mounted above the sump, below floor-level. A similar arrangement is employed for the 200-gal. honing-fluid sump, which is served by a Mirrlees pump, of 40 gal. per min. capacity, a second pump, of identical type, being provided as a standby.

The main coolant installation, for the supply of sulphurized oil, is of exceptional capacity, and can deliver a maximum of 400 gal. per min. It is

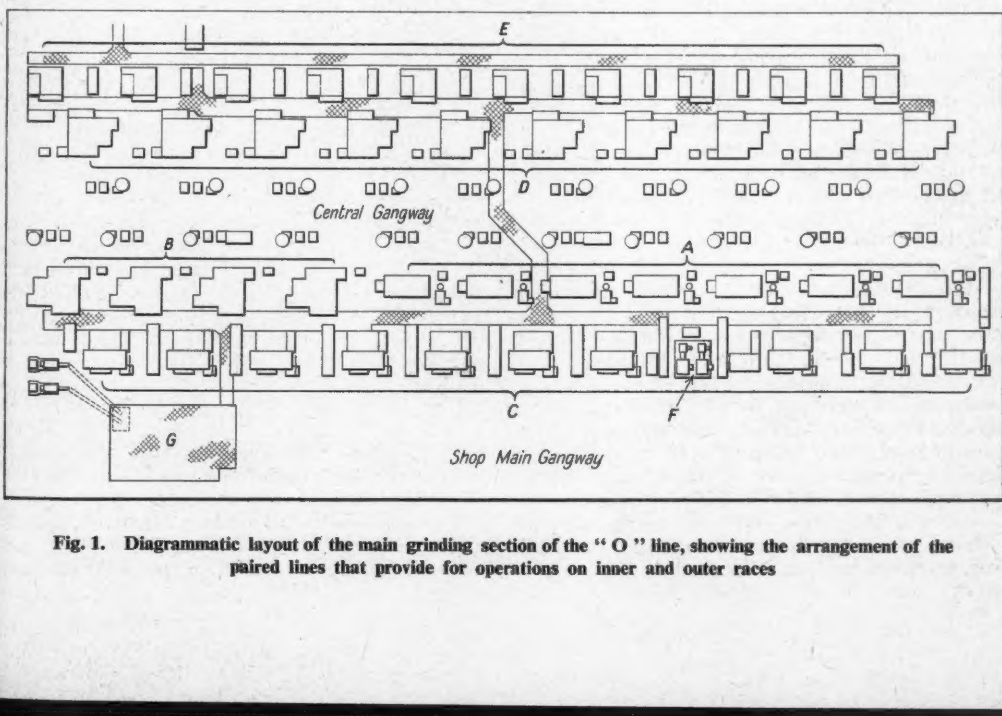


Fig. 1. Diagrammatic layout of the main grinding section of the " O " line, showing the arrangement of the paired lines that provide for operations on inner and outer races

Fig. 2. View of the main coolant processing plant, showing part of the line of seven De Laval clarifiers, which are mounted above the 4,000-gal. tank. Flow rates up to 400 gal. per min. can be handled

currently operated at flow rates of 150 to 200 gal. per min., so that there is adequate reserve capacity for future expansion. Clarification plant is housed in an annexe, that extends outwards from an outer wall of the factory, adjacent to the machine lines. In the floor of the annexe there is a large pit, with a welded steel lining, the lower portion of which serves as a sump of 4,000 gal. capacity. On a steel "deck," immediately above this sump, is mounted a line of seven De Laval Turbomatic centrifugal clarifiers, as shown in Fig. 2.

From the machines, oil is returned to the plant through the floor-channels, and it is discharged into the header-trough seen at the left, whence it is diverted to the individual clarifiers. Each clarifier has a throughput of 33 gal. per min., and is driven at 1,450 r.p.m. by a 5-h.p. electric motor. Dirty oil is fed continuously into the upper end of the inclined bowl, which is open at the bottom and incorporates a series of hollow conical shells, arranged apex-downwards. The oil passes over the surfaces of the cones, and tends to flow inwards towards the centre of the latter, but the solids are separated, and are deposited on the walls of the bowl. The clarified oil drains through a pipe at the bottom of the cones, into the sump below.

Immediately below the bowl there is a steel pan, and at predetermined intervals, the bowl is stopped within 8 sec., by an automatic braking system. This sudden deceleration causes the oil to swirl round the walls of the bowl, so that the adhering solids are dislodged and "dumped" into the pan. The machine is automatically re-started, and the timing mechanism for initiating the "dumping" cycles of the various clarifiers in the line is arranged so that at no time are they all stopped simultaneously. Each bowl has a sludge capacity of 4 gal., and, normally, the sludge is removed from each pan at regular intervals. As a safeguard against the pans becoming excessively full of sludge, however, each is fitted with a float-operated switch, that automatically stops the clarifier if a certain level is exceeded. As removed from the pans, the extracted solids are saturated with oil, a useful proportion of which is recovered by a draining and pressing process. A total of about 1 ton of solids is removed from the cutting oil each day.

Return of the clarified oil from the sump to the machine-lines in the factory, is effected by means of a Mather & Platt type A centrifugal pump, which may be seen at *H*, Fig. 2. This pump is driven by a 5-h.p. electric motor, and a second pump, of similar type, provides reserve capacity, as well as serving as a standby. Immediately beyond the pumps, as viewed in Fig. 2, there is a cabinet which houses all the electrical controls for the clarifiers and pumps. An automatic warning system gives an audible signal in the factory should the supply pressure in the oil delivery line fall below the normal working value of 20 lb. per sq. in. The main sump is periodically topped-up from a 1,500-gal. tank, outside the building which is replenished from time to time by road tanker, this form of bulk delivery being more economical than supply in drums. Total losses of oil in the system, due principally to "carry over" on the work, amount to some 70 gal. daily. No special provisions for cooling are needed because of the large volume of oil that is circulated, and natural dissipation of heat through the various floor-channels, pipelines, and the pit walls.

ELECTRICAL SERVICES

The machine lines are served by a 400-volts, 3-phase and neutral, mains supply, which provides for all basic machine requirements. Single-phase, 230-volts current for all machine auxiliaries, including automatic gauging, automatic feed hoppers, and machine lighting, is taken from one phase-line and

neutral of the main supply. For machine lighting, the 230-volts single-phase current is stepped-down to 25 volts by suitable transformers. Power for the high-frequency spindle-heads of the Bryant machines is supplied by four A.E.I. inductor/alternator sets, installed in the roof, two of which serve as stand-by sources. Each pair of sets covers a frequency range of 633 to 766 cycles per sec., which corresponds to 38,000 to 46,000 r.p.m. for 2-pole spindle heads, and 19,000 to 23,000 r.p.m. for 4-pole heads. The output voltages are 220 and 194 at 766 and 633 cycles per sec. respectively.

AUTOMATIC FEED EQUIPMENT

Before delivery to the section, all work is ground on the periphery and end faces, to ensure accurate holding and location during the succeeding stages. Typical tolerances on the inner and outer races, as received in the section, are as follows:—external diameter, 0·0002 in.; roundness, maximum diameter to minimum diameter, 0·00005 in.; face squareness, 0·0001 in.; face parallelism, 0·0001 in. Fig. 3 is a view along the centre gangway of the section, showing the equipment for automatically feeding the inner races to the Bryant and Heald machines (*A* and *B*, Fig. 1) and thence to the Landis machines (*C*, Fig. 1). This equipment, it may be noted, was designed and built by the company, and there are generally similar arrangements on the other side of the gangway, for feeding outer races.

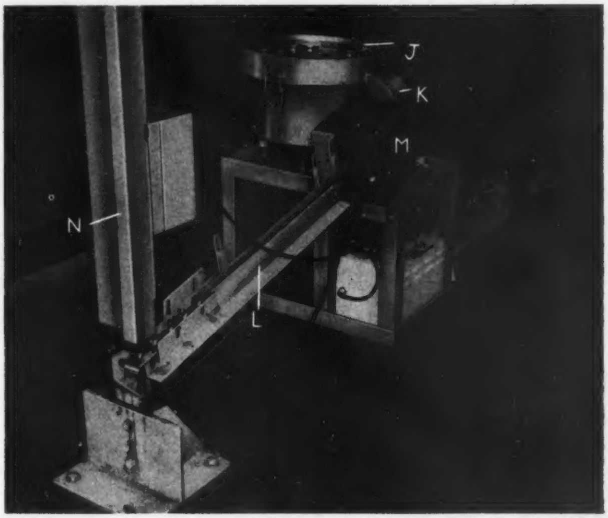


Fig. 4. Close-up view of a typical feed unit, serving one of the Bryant machines, showing principal features. The demagnetizing head *M* is provided to ensure correct chucking and ejection on the machine

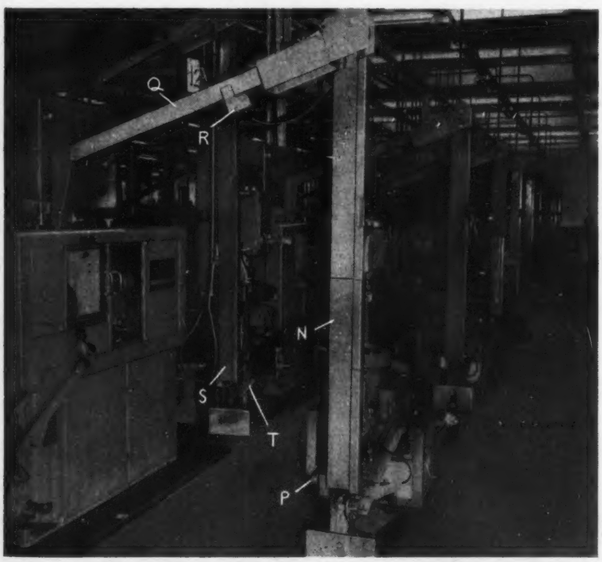


Fig. 3. In this view along the central gangway may be observed the arrangement of the automatic feed equipment that delivers the components to the machines. This equipment was built by the company

A close-up view of a typical feed unit, serving one of the Bryant machines, is given in Fig. 4. Inner races are loaded into the vibratory bowl feeder *J*, wherein they are arranged so that they lie flat on the floor of the bowl. One inner race at a time is fed through the curved guide *K*, into the inclined chute *L*. As the race travels down the chute, it passes through the demagnetizing head *M*, which ensures that when the race reaches the machine, it is

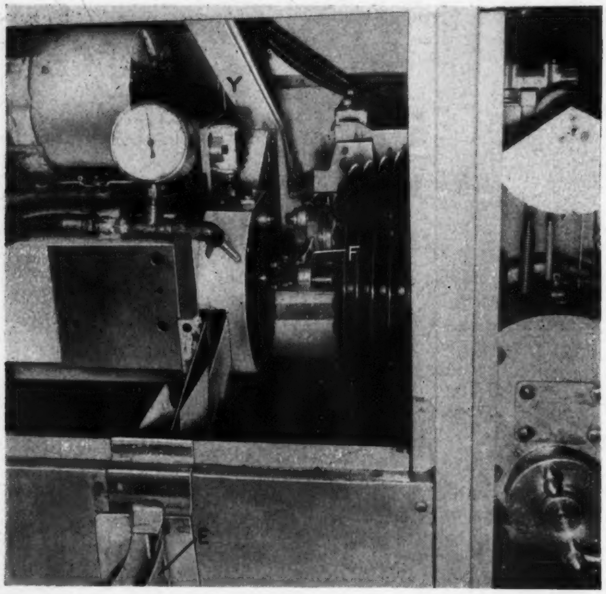


Fig. 5. Bryant Centalign machine set-up for bore grinding inner races to 40 mm. diameter. The example seen is one of three originally installed in the pilot plant and is equipped for "post-gauging"

chucked, and subsequently ejected, correctly. From the bottom of the chute, the component is carried upwards through the vertical duct *N*, Fig. 3 and 4, which encloses an endless roller chain. This chain, which is driven by an f.h.p. electric motor (*P*, Fig. 3) through a reduction-gear and sprocket, is provided with a series of equally spaced, hooked, carrier fingers.

As the fingers pass round the sprocket they extend radially, and each engages the bore of the lowermost race in the chute *L*, and carries it to the top of the duct. As the chain passes over the upper (idler) sprocket, the race is discharged into another inclined chute, *Q*, Fig. 3, whereby it is delivered to the machine. As a safeguard against over-feeding, a trip and micro-switch are provided at *R*, which are so arranged that when the chute *Q* is nearly filled, the power supply to the motor *P* is cut off and the chain is stopped. When sufficient components have been drawn from the chute to release the trip, the micro-switch closes, and drive to the chain is re-started. As ground components are discharged from each machine, they are automatically transferred to the next machine in the sequence by a similar unit, as at S. In this instance, however, vibratory bowl feeders are not used, and the components are raised directly from the bottoms of the discharge chutes associated with the machines, one of which is seen at *T*.

BORE GRINDING INNER RACES

A close-up view of the working zone of one of the Bryant Centalign machines for grinding the bores of inner races is given in Fig. 5, and the

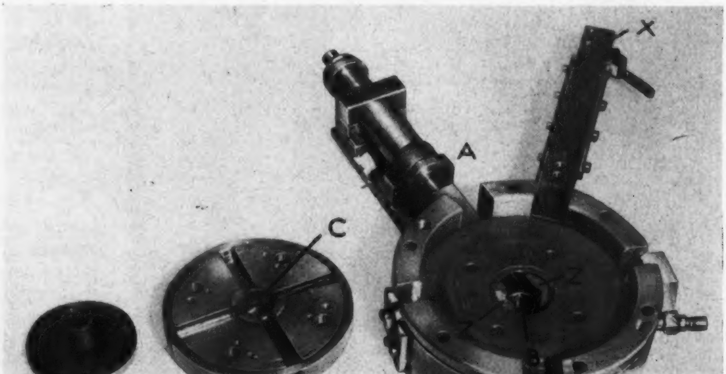
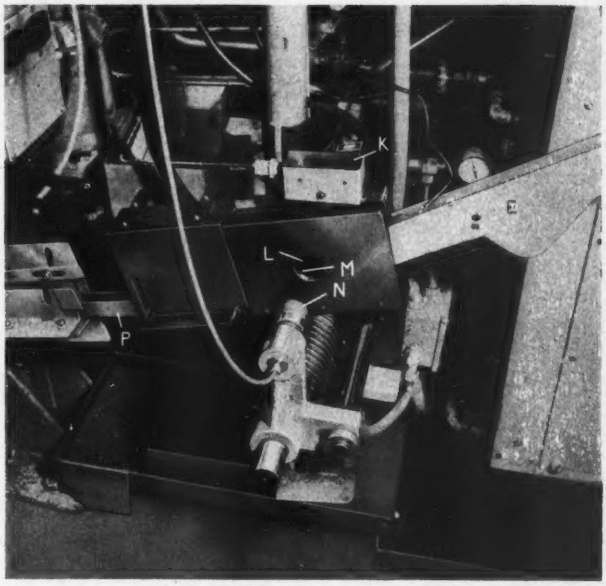


Fig. 6. The principal tooling elements for bore grinding inner races on the Bryant Centalign machines are here shown separately, for clarity. A carbide ring *C* serves to locate the work by the external diameter

Fig. 7. Automatic air gauging heads, of the design here shown, are provided on the "post-gauging" Bryant machines, and control the "back-off" position to which the wheel is withdrawn before it is advanced for dressing



particular machine shown is one of three originally installed in the pilot plant. These three machines are equipped for automatic feedback size-control, on a "post-gauging" basis, as will later be described, but the remaining Bryant grinders are each provided with an automatic "in-process" plug-gauging system. Generally similar arrangements for feeding and locating the work are employed on both types of machines, and to enable the operation of the equipment cycle to be followed more clearly, the principal elements of a typical unit are shown in Fig. 6, removed from the machine. These elements comprise a main body *U*, a chuck assembly *V*, and a rear ejector *W*. When fitted to the machine, the chuck assembly is mounted on the spindle nose, with the rear ejector behind it, and is accommodated in the recess in the rear face of the main body *U*, which is bolted and dowelled to the headstock.

Extending from the main body there is a magazine chute *X*, into which the components are delivered by the automatic feeding equipment, by way of the chute *Y*, Fig. 5. The main body incorporates spring-loaded V-jaws *Z*, Fig. 6; an air-operated pusher *A*; and an annular front thrust member *B*, which is actuated by the coolant, supplied at a pressure of 40 to 60 lb. per sq. in. A carbide ring *C*, in the centre of the chuck assembly, serves to locate the work accurately by its periphery, and a narrow internal flange, at the rear end of the bore in the chuck body, serves as a datum face to hold the work square.

When the preceding component has been finish ground, the front thrust member *B* is released, and the ground component is pushed out of the chuck, into the V-jaws *Z*, by the rear ejector *W*. The air-operated pusher *A* is then advanced to thrust a fresh component from the bottom of the magazine chute *X*, into the V-jaws, and the ground component is ejected through the aperture *D*, into the discharge chute *E*, Fig. 5. Next, the pusher *A* is withdrawn and coolant pressure is again applied to the front thrust member, so that the member pushes the component through the V-jaws into the carbide locating ring *C*, and clamps it against the internal flange in the chuck body. The latter unit, it may be noted, rotates continuously, and is not stopped for loading.

When the fresh component is located and clamped in the chuck, the wheel is advanced into the bore and then reciprocated axially. At the same time, it is moved horizontally, towards the rear of the machine, at the appropriate roughing feed rate. In Fig. 5, the machine is seen engaged on grinding races with a finished bore-diameter of 40 mm., +0, −0·0005 in., and for races of this size, the total grinding allowance on diameter is approximately 0·012 in. Of this total, some 0·011 in. of metal is removed during the roughing stage, at a feed of 0·001 in. per sec., using a $1\frac{3}{8}$-in. diameter, grade BA80-L5-VFBLU Carborundum wheel, which has a face-width of $\frac{3}{8}$ in. The wheel is run at 19,000 r.p.m., and the work is rotated at 630 r.p.m.

AUTOMATIC WHEEL-DRESSING

On completion of the rough-grinding stage, the wheel-head is withdrawn, clear of the work, to a position governed by an adjustable "back-off" stop. The setting of this stop is controlled automatically by feedback signals generated by the

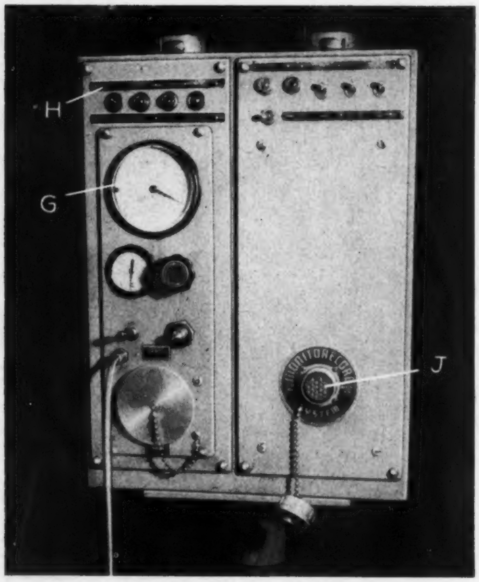


Fig. 8. Sheffield Lectolair equipment cabinet and control-panel associated with the air gauging head seen in Fig. 7. The dial-type indicating instrument can be read directly to 0·000025 in.

associated gauging equipment, and derived from the preceding component. Next, the wheel-head is advanced from the "back-off" position through a small predetermined distance to the dressing position, by a compensating mechanism, to allow for wheel-wear and the amount of abrasive material removed during dressing. This distance, it may be noted, is adjustable manually to provide an allowance from zero to 0·005 in. on wheel-diameter. At the end of this motion, the diamond is swung into the working position seen at *F*, Fig. 5, and during the ensuing axial withdrawal motion of the wheel-head, the wheel is traversed past the diamond. At the end of the dressing traverse, the diamond is swung clear, and the wheel is returned to the grinding position. The work is finish ground at a feed of 0·001 in. per 3 sec., after which the wheel-head is withdrawn, and the ground component is ejected into the chute *E*, Fig. 5, as already described.

AUTOMATIC GAUGING

At the bottom of the chute, there is an air-operated air gauging head, of the design shown in Fig. 7, with which is associated the Sheffield Lectrolair (Catmur Machine Tool Corporation, Ltd.) equipment cabinet and control panel shown in Fig. 8. The dial-type indicating instrument *G* can be read directly to 0·000025 in., and in conjunction with the coloured signal-lamps *H*, provides for setting the various relays and contacts to operate at the required limits. A multiple-contact socket *J*, on the right-hand section of the panel, provides for plugging-in an automatic size recorder, and a row of switches at the top enable the various functions to be selected individually, for setting and calibration.

When the ground component reaches the bottom of the chute *E*, Fig. 7, it trips a mercury switch *K*, and is arrested in line with the aperture *L* by a retractable stop *M*. The action of tripping the mercury switch initiates the gauging cycle, and the air plug-gauge *N* is advanced through the aperture *L*, into the work-bore. An adjustable timer controls the period for which the plug-gauge remains in the bore, and is set to give a dwell of 5 sec. This dwell provides the necessary interval for the pneumatic gauging circuit to reach stability; for the various contacts and relays to operate; and for the mechanism controlling the setting of the "back-off" stop to respond to the feedback signals, in readiness for the wheel-dressing stage immediately before the next component is finish ground. At the end of this dwell period, the plug-gauge and stop *M* are withdrawn, thereby releasing the gauged component into the discharge chute *P*, whence it is conveyed to the next machine by the automatic feed equipment already described.

The air gauging equipment seen in Fig. 7 is provided with a gating system whereby ground components outside the permissible tolerance-range are rejected, and released into a tray. If two, or any other preselected number of ground components are rejected consecutively, the machine is stopped. To provide a safety margin, the gauging-circuit contacts that operate the gating system are set to reject workpieces with bores that are 0·00005 in. inside the actual permissible limits. These contacts are supplementary to the main contacts that provide the feedback signals for controlling the wheel "back-off" position, which are set to a further 0·00005 in. inside the "reject" limits. These "inner" limits are termed the "approach" limits.

Associated with the main contacts, there is a counter that can be set to record any number of consecutive components which reach or exceed the "approach" limits, up to a maximum of nine, and the appropriate corrective feedback signal is only delivered to the "back-off" mechanism after this preset number of parts has been recorded. This

arrangement ensures that the "back-off" settings are not unduly disturbed by the occasional passage of an isolated "rogue" component, which may be initially outside the normal working limits. In practice, the counter is set so that the corrective signals are transmitted to the "back-off" mechanism, after two consecutive parts have exceeded the "approach" limits.

From the earlier description of the dressing stage of the cycle, it will be apparent that the "back-off" position is virtually an adjustable datum, from which the wheel is progressively advanced, by controlled increments, to the successive dressing positions, by the compensating mechanism. As long as no corrective feedback signal is delivered to the "back-off" mechanism, a constant nominal amount, equivalent to the manually preset allowance, is removed from the periphery of the wheel during each dressing pass. If a corrective signal is received, however, the "back-off" position is moved in one direction or the other from its "nominal" position, so that an amount correspondingly greater or smaller than preset allowance is removed from the periphery of the wheel during the ensuing dressing pass. This correction is transferred, in turn, to the in-process component, during the finish grinding stage. Thereafter, the bores of successive components of the same initial size are ground within the "approach" limits, until a disturbing factor, such as dimensional "drift" in the initial size, results in another feedback signal and correction.

On the Bryant Centalign machines, all phases of the working cycle are controlled by a set of ten simple plate cams, mounted on a common shaft, and the cam and shaft assemblies are readily interchangeable, thus facilitating the setting-up of various programmes. All longitudinal motions of the wheel-head are controlled by a main cam on the same shaft, and are imparted by a hydraulic servo-follower system, which operates through an 8:1 ratio-lever and pantograph linkage. Since the hydraulic system operates at a working pressure of 1,000 lb. per sq. in., the responses are particularly rapid. The remaining cams control and phase the various other functions, such as the initiation of wheel-head reciprocation, chucking, dressing, and cross-slide feed, also automatic stoppage of the machine, with the wheel-head in the dressing position, when the wheel requires replacement. This latter condition is signalled by a micro-switch on the wheel-head cross-slide, and, typically, the wheel-life is of the order of 200 components. The cycle-time per component is 17 to 22 sec., according to the size.

AUTOMATIC PLUG SIZING CONTROL

As already mentioned, the remaining Bryant Centalign machines in the line are equipped with automatic plug-gauge sizing control, for in-process gauging. For this purpose, a mechanically-operated plug-gauge is incorporated in the work-head, and is brought into use immediately after the wheel-dressing stage of the cycle. The gauge is thrust towards the bore of the work by pneumatic pressure, and is spring-loaded in the same direction. Each time the wheel spindle is advanced beyond the inner end of the work-bore, a button on the end of the spindle contacts the gauge and thrusts it towards the rear of the work spindle against spring pressure. Finish grinding is terminated automatically by the entry of the plug-gauge into the work-bore when the required size is reached.

Entry of the plug-gauge early in the finish-grinding stage corresponds to "work rough ground oversize," and late, to "work rough ground under-

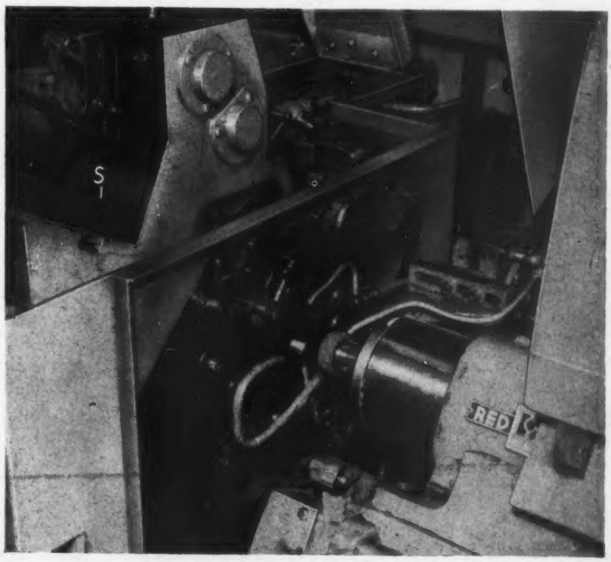


Fig. 9. Typical set-up on one of the Heald 190A machines for bore grinding inner races. The work is supported on the "shoe centreless" principle, whereby errors such as ovality are minimized

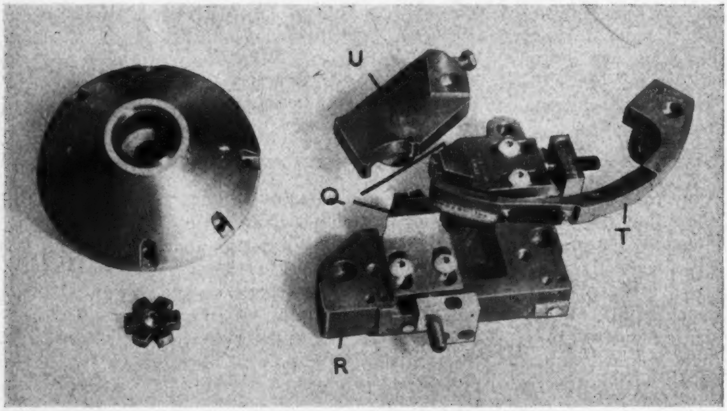


Fig. 10. Typical tooling elements for the Heald 190A machines, shown separately for clarity. The magnetic driver is seen at upper left, and immediately below it, the carbide-tipped plug-gauge

size." Therefore, in order to leave the correct amount of stock for finish grinding on subsequent components, the plug must enter the bore of the in-process component at the correct stage during finish grinding, corresponding to a particular angular position of the wheel-head feed cam. Two consecutive early or late entries of the plug-gauge initiate corrective feedback signals to the "back-off" mechanism, in the appropriate direction, with the result that the error is corrected at the wheel-dressing stage that follows the rough grinding of the in-process component, in readiness for grinding the next workpiece.

A feature of the "in-process" plug gauging machines is the provision of a reverse wheel-head feed motion, which comes into operation when the finish grinding stage of the cycle is terminated. Immediately this reverse feed has released any "springing" of the wheel spindle, a "jump-back" hydraulic cylinder rapidly withdraws the wheel-head, so that the wheel is approximately 0·005 in. clear of the bore. It is thus ensured that, during the ensuing axial withdrawal motion, the bore is not spirally marked by the wheel. The cycle-times on these machines are similar to those quoted for the preceding examples.

HEALD 190A CENTRIMATIC MACHINES

Automatic plug-gauge sizing control is also used on the Heald 190A Centrimatic machines for bore-grinding inner races, and a close-up view of the working zone of one of these machines is given in Fig. 9. The "shoe centreless" principle on which these machines operate was described in MACHINERY, 91/1021—1/11/57, and entails the use of support-shoes that engage the periphery of the work. These shoes are arranged so that the rotational axis of the work is offset by 0·005 in. from the rotational axis of the work-head spindle, whereby the work is driven frictionally. The direction of the offset, and the position of the shoes, is such that the work is constantly thrust against them, and is accurately located by the periphery. Among the advantages claimed for this system may be mentioned the fact that the shoes bridge any waviness in the external surface, so that it is not reproduced on the internal surface. Moreover, ovality and similar errors are minimized, instead of being communicated to the internal surface by elastic deformation, as may occur with locating elements of the ring or cup design.

The various tooling elements for the Centrimatic machines are shown separately, for the sake of clarity, in Fig. 10, in which the annular magnetic driver fitted to the work-spindle is seen at the upper left, with the plug-gauge immediately below it, and the support-shoes at *Q*. As may be observed, the latter are arranged 90 deg. apart, at positions corresponding to "3 o'clock" and "6 o'clock." All the members of the shoe-holder bracket assembly *R*, it may be noted, are preset in the toolroom, and the setter is only required to bolt the complete assembly in position on the machine. This system is applied generally to the tooling throughout the section. All critical surfaces subject to wear, such as those of the plug-gauge and support-shoes, are provided with carbide inserts.

When a component reaches the bottom of the magazine S, Fig. 9, it rests against a spring-loaded gate. At the end of the machine cycle, the curved ejector-arm *T*, Fig. 10, thrusts the ground component off the support-shoes, into the discharge chute, and then returns to the position seen in the figure. Meanwhile, the upper arm *U* swings upwards and then downwards, to transfer a fresh component from the bottom of the magazine on to the support-shoes *Q*, where it is held by the revolv-

ing magnetic driver. The work is then ground in roughing and finishing stages, and the wheel is dressed immediately prior to the finishing stage, as on the Bryant machines. In Fig. 9, the machine is seen engaged grinding the bore of an inner race that is 20 mm. wide, and the nominal diameter of the bore is 50 mm. The work is run at 550 r.p.m., and the grade 19A80-L7-VBE Norton wheel, of $1\frac{7}{8}$ in. diameter by $\frac{9}{16}$ in. wide, is run at 13,875 r.p.m. Approximately 0·016 in. (on diameter) is removed from the bore during the roughing stage, and 0·001 in. during finishing.

On the Centrimatic machines, the cutting feed rate is controlled automatically, on the basis of the power consumption of the wheel-spindle motor. Initially, the wheel is rapidly advanced towards the work, and then slowed to the cutting feed rate by the automatic control system, so that idle time is minimized. Thereafter, should the load on the spindle motor become excessive, the feed motion is temporarily interrupted, and is resumed when the load returns to the optimum value. In consequence, springing of the spindle is kept practically constant, with a beneficial effect on accuracy. Grinding feed is applied hydraulically, and the hydraulic circuit is controlled by electrical signals derived from instruments associated with the spindle driving motor.

During the finish-grinding stage of the cycle, the final sizing operation is performed on a time basis. Towards the end of the cycle, movement of the work-head actuates a trip, which sets an automatic timer in operation to control the spark-out dwell. If, on expiration of the timed period, the plug-gauge has not entered the work-bore, a further increment of feed is applied, and the setting is maintained for a further controlled period of 3 to 5 sec., termed the "overtime cycle." If, at the end of this additional period, the plug-gauge has still not entered the bore, the machine is automatically stopped. The overtime cycle serves to operate a feedback signal system, in such a manner that two consecutive overtime cycles result in a corrective signal being transmitted to a mechanism that controls the setting of the dressing diamond, so that compensation is made before the next component is ground. Conversely, if the plug enters the bore before the expiration of the first time period, for two consecutive components, corrective signals are transmitted to the diamond setting mechanism to provide for compensation in the opposite direction. The cycle-time on these Heald machines ranges from 15 to 22 sec.

Equipment and methods employed by the company for track-grinding inner races, and track-grinding and honing outer races, will be discussed in a later article.

Ferro-Tic C Steel-bonded Carbide Dies

It is reported that good results are being obtained by the Woodhaven Metal Stamping Co., Inc., New York, U.S.A., with press tools made from Ferro-Tic C steel-bonded carbide material which is a powder metallurgy product supplied by the Sintercast Division, Chromalloy Corporation. As compared with tool steel, it is stated, tools made from this material last ten times as long between grinds, and because much less stock need be removed, they can be reground five times as often. Another advantage is that galling is not a serious problem, so that lubrication is less critical.

In the annealed state, the material can be drilled, turned, reamed, and threaded with normal tool-room equipment, and can then be hardened to 71 Rockwell C by treatment similar to that employed for tool steel. Owing to the high dimensional stability, tools can be machined to close limits prior to hardening, and only superficial polishing is subsequently required. It may also be noted that the high wear resistance of the hardened material is combined with good impact strength. If a tool is no longer required, it can be annealed and re-machined for other work.

The illustration shows the upper member of a tool for blanking and drawing cups from 0·031-in. thick stainless steel. It is provided with a drawing ring insert of Ferro-Tic C and the remaining parts are made from high-carbon, high-chromium tool steel.

The upper member of a combination tool for blanking and drawing stainless steel cups. The drawing ring insert is of Ferro-Tic C steel-bonded carbide

A.M.T. Unit Head Machines

Some Set-ups for Machining Components for Oil Pumps

By G. W. MASON, Associate Editor

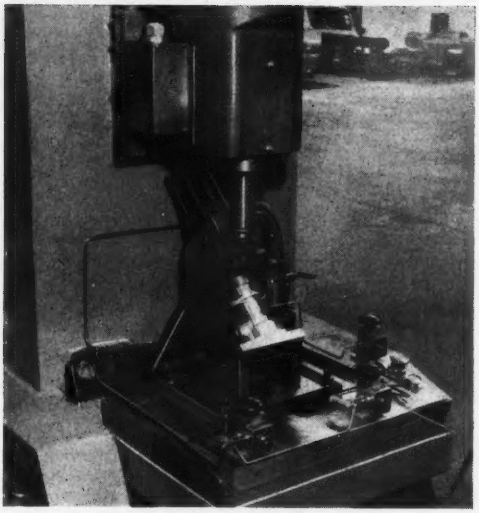


Fig. 2. Close-up view of the spindle head and the work-holding fixture on the A.M.T. unit-head drilling machine shown in Fig.1

In the illustrations are shown two unit head machines which have recently been built by A.M.T. (B'ham), Ltd., Bristol Road, Bournbrook, Birmingham, 29, for Vauxhall Motors, Ltd., Luton, for performing operations on components for oil pumps.

The machine in Fig. 1 is employed for drilling a $\frac{1}{16}$-in. diameter hole at an angle of 45 deg., which connects with a bore in the light-alloy pump body, and a close-up view of the spindle head and the work-holding fixture is given in Fig. 2. The fixture is so designed that the workpiece is inclined at the required angle, and for clamping, a circular pad, attached to the piston rod of an air cylinder, is applied to the end of the bore. This air cylinder is controlled by three mushroom - type valves, two of which are depressed simultaneously for clamping, and two for releasing the work.

Fig. 1. A.M.T. unit-head machine for drilling a $\frac{1}{16}$-in. diameter hole at an angle in an oil pump body

A direct drive to the drilling spindle, at a speed of 3,000 r.p.m., is provided by a motor flange-mounted on top of the head, and the latter is traversed on the column guideways by an air-hydraulic system, which gives rapid approach, feed and quick return on an automatic cycle. During the drilling stroke, pressure fluid is passed to the upper end of the hydraulic traversing cylinder for the spindle head by compressed air which is admitted to an air-oil reservoir. At the same time, fluid which is discharged from the lower end of the cylinder is directed to a second reservoir. For the quick return travel, compressed air is delivered to the second reservoir, with the result that the traversing cylinder is reversed. The working cycle is started by a push-button, and feed and rapid traverse movements are controlled by switches mounted on the side of the spindle head, which are operated by adjustable stops, and energize solenoid valves in the air-hydraulic system. An air valve mounted on the side of the column provides for stepless variation of the drilling feed. Compressed air and hydraulic equipment was supplied by Martonair, Ltd., Parkshot, Richmond, Surrey.

In Fig. 3 is shown a unit head machine fitted with an A.M.T., 36-in. diameter, 3-station indexing work-table, for performing milling and reaming operations on light-alloy pump covers. At the end of each operating cycle, a completed component is removed from one fixture of a pair on the table, which has been brought to the loading and unloading position. Another pump cover, on which milling of the joint face, also milling of an oil relief slot has been carried out, is now removed from the

second fixture, inverted, and loaded into the first fixture. Finally, a fresh part is loaded into the second fixture, and cam-operated clamps on both fixtures are tightened by hand. The table and a pair of fixtures at the loading and unloading position may be seen more clearly in the close-up view Fig. 4.

The table is now indexed to the left to present the fresh component to an A.M.T. No. 2 size unit head, which has a 5-h.p. driving motor, and is fitted with a vertical-spindle milling attachment. This attachment normally carries a Galtona (Richard Lloyd, Ltd.) 4-in. diameter inserted-blade cutter, which provides for milling the joint face on the pump cover. A spindle speed of 1,500 r.p.m. is employed for this operation, and a feed of 14-in. per min. is applied to the spindle head on its base guideway. A surface finish of 30 micro-inches is specified for the joint face, and to avoid marking the machined component, no return movement is imparted to the spindle head following the cutting stroke. Feed is applied to the spindle head in the reverse direction for milling the joint face on the next component.

Fig. 4. Work-holding fixtures are mounted in pairs on the 36-in. diameter 3-station indexing table. For indexing, the top portion of the table is supported by compressed air so that it can be easily turned by hand

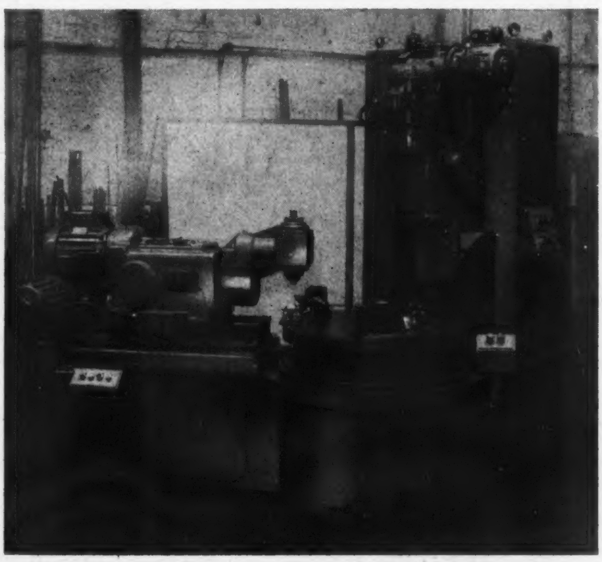


Fig. 3. This unit-head machine is designed for milling the joint face and an oil relief slot, also reaming a 0·552/0·553-in. diameter hole in oil pump covers

When the table has again been indexed, the 0·010-in. deep oil relief slot is milled in the joint face by a 5-in. diameter cutter, mounted on a right-angle spindle attachment on a No. 1 size unit head. This unit is secured to a vertical face on the column, and for the milling operation, plunge feed is applied to the spindle head. The $\frac{3}{16}$-in. wide cutter has inclined side cutting edges, and the width at the periphery is 0·090 in. Simultaneously with the milling operation, a second No. 1 size unit head is advanced on its base guideway, in the horizontal direction, for reaming a 0·552/0·553-in. diameter hole in the partly machined pump cover which is held in the first fixture of the pair. For this operation, the spindle is run at a speed of 443 r.p.m., and a feed of 0·03 in. per rev. is employed. The cycle time required for the full sequence of machining operations on

the pump cover component is about 30 sec.

For indexing the table, depression of a pedal-type valve, built into the base of the machine, causes a plunger to be moved downwards clear of a bush in the top portion, by the action of an air cylinder incorporated in the table base. During its downward movement, the plunger operates another valve, with the result that compressed air is delivered to an annular groove in the top portion of the table, so that the latter is raised slightly clear of the base. Since the top portion of the table is now supported by compressed air it can be turned by hand with little effort. The top portion is usually turned through a small angle past the required position, and when the pedal has been released, it is rotated in the opposite direction until the plunger enters another bush. At the same time, the second valve is closed to shut off the compressed air supply, with the result that the top portion of the table is lowered on to the base.

Improved Point Form for Stellite Drills for Hardened Steel

For drilling operations in hardened steel with a solid Stellite tool of substantially triangular form, it was found that quicker penetration could be achieved by grinding the point to the form shown at *A* in Fig. 1, also in Fig. 2, rather than the form indicated at *B*, which is that normally employed. As may be seen, six cutting edges are provided by grinding the point at two angles, namely, approximately 15 deg. at the tip, and 45 deg. for the secondary cutting edges. Grinding is carried out in such a manner that the secondary edges lie on the faces of the triangular cross section of the cutter, and the three tip cutting edges are disposed at right-angles to them, as can be seen in the end view, Fig. 2.

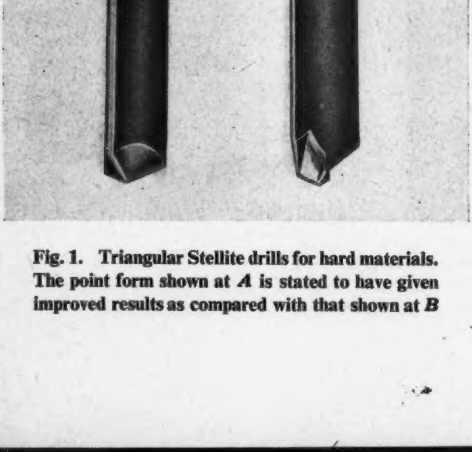


Fig. 1. Triangular Stellite drills for hard materials. The point form shown at *A* is stated to have given improved results as compared with that shown at *B*

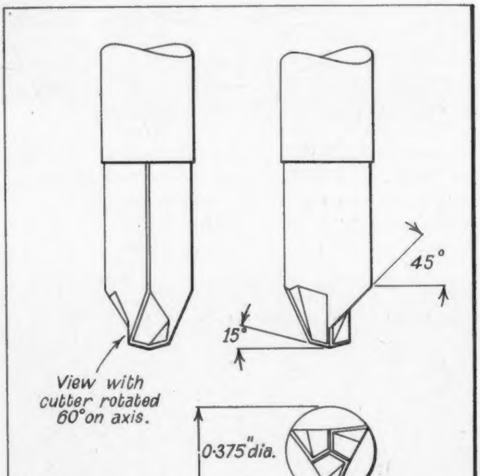


Fig. 2. Details of the recommended point form for Stellite drills. A drill ground to this form penetrated a 1-in. block of toughened KE 672 steel in 60 sec. Less feeding force is required as compared with that for a conventional point form

The drill illustrated is of 0·375 in. diameter and the time required for drilling a hole through a 1-in. thick block of toughened KE 672 steel is 60 sec. With a drill ground to the form shown at *B* in Fig. 1, the time required was 93 sec. The speed employed for both drills was 1,455 r.p.m., and it may be noted that less feeding force was required with the modified point.

Some Typical Applications of Induction Heating

By N. G. GAGLIARDI*

BECAUSE THE EQUIPMENT is versatile, and can be accurately regulated and readily automated, heating by induction offers advantages for many critical operations where high outputs are required. If careful control of heat flow is vital, the process is sometimes the only practical method by which an operation can be carried out. Often, moreover, processes such as brazing and hardening can be combined in a single set-up.

A fully automatic machine for the induction case-hardening of motor vehicle gudgeon pins is seen in Fig. 1. Employed by a Mexican manufacturer of replacement parts, this equipment was developed by the Induction Heating Corporation, Brooklyn, N.Y., U.S.A., to handle more than 100 different sizes of gudgeon pins from ½ to 1 in. diameter and from 1 to 4 in. long. These pins are hollow and are generally made from tubing. They are fed from a magazine to a pick-up station in the machine where each is gripped by a pair of air-operated centres. While held between the centres, the pin is then rotated and moved rapidly lengthwise through an induction-heating coil and a ring type water-spray quenching unit. At the end of the stroke, the centres release the pin and return at high speed in readiness for the next cycle. Rotation of the part ensures a uniform hardness pattern. About 700 gudgeon pins, 3 in. long by ¾ in. diameter, can be case hardened in an hour under fully automatic operation. The induction coil and quenching unit can be clearly seen in the illustration.

The machine, which can be adapted to handle many other cylindrical parts, is provided with a 30-kW., 400-kilocycle oscillator. Parts are held between the centres under a force of 85 to 100 lb. and the stroke cycle is controlled hydraulically. Gudgeon pin travel through the induction coil is carefully regulated to obtain a 0·025- to 0·030-in. depth of case, and a hardness value of 60 to 65 Rockwell C. scale.

Several coils are necessary to cover the full range of gudgeon pins, each coil providing for pins with diameters differing by about 1/32 in. A safety device stops the machine if the part is not held correctly between the centres.

Only 6 sec. is required to braze on a carbide tip and harden and temper each tooth of a saw blade of the circular type, in the induction-heating equipment illustrated in Fig. 2. No subsequent straightening of the teeth is necessary, since the heating is localized. The installation—employed by a large manufacturer of circular steel saw blades—comprises a Ther-Monic 5-kW. induction heater with dual outputs, a water-to-air heat exchanger (in the stand), and two work stations, only one of which is shown. At the station supplied from the right-hand output connections of the generator there are offset adapters, to permit the use of additional tooling without interfering with the main function of the equipment. A

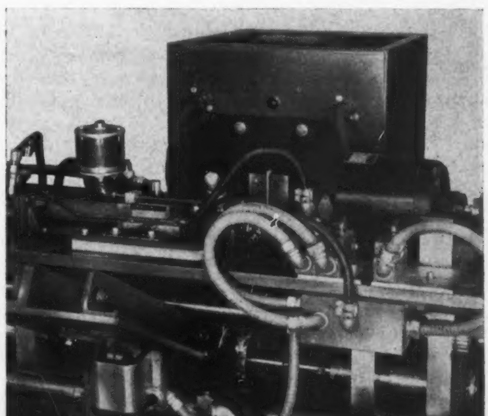


Fig. 1. Close-up view of an automatic machine for induction case-hardening gudgeon pins. The component is held between centres and moved axially through an induction-heating coil and water-spray quenching ring

* Induction Heating Corporation, U.S.A.

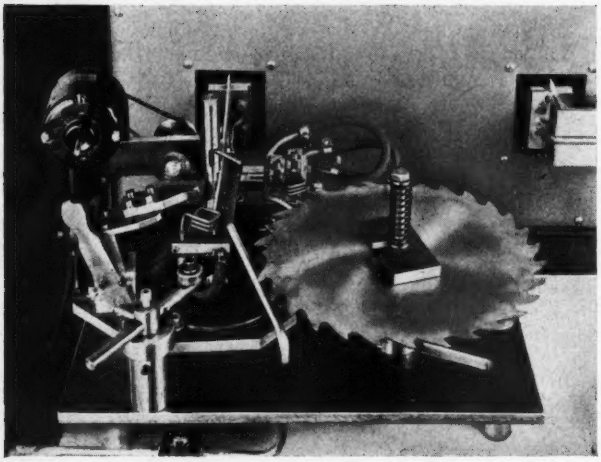


Fig. 2. At this set-up, two induction-heating coils operate simultaneously to braze carbide tips and harden and temper the teeth of circular saw blades

selector switch on the control panel energizes either output for the required cycle.

Since carbide tips are brazed to both sides of a circular saw blade, on alternate teeth, only every other tooth is processed at one time. Once the blade has been loaded, a tooth is manually indexed into place over the brazing coil. A carbide tip, together with a 0·0025-in. Easy-Flo No. 3 (silver-brazing alloy) pre-form, is placed on the tooth and accurately positioned by a lever-operated locator. A spring-loaded hold-down device is then tripped and the locator is retracted. At this point, the cycle button is pressed and the heating coils for both brazing and tempering are energized.

For brazing, the coil heats the blade tooth to approximately 1,500 deg. F. to melt the filler alloy. Immediately after brazing has taken place, an air blast quenches the high-carbon steel, producing a hardness of 63 Rockwell C.

A tempering coil is displaced by a number of teeth from the brazing coil, to allow for further cooling after the brazing - hardening cycle, and is adjusted to heat the previously hardened tooth to the correct temperature in the same cycle time as is required for brazing. The final hardness, after tempering, is 55 Rockwell C. A spring-loaded detent holds each tooth in position until it is released for indexing. The blade-holding mandrel has a spring-tensioned hold-down to permit easy loading and is adjustable in a slot to accommodate all the sizes of blade to be handled. As seen in the foreground of the illustration, the spring-loaded detent is mounted directly over the air shut-off valve. The carbide-tip locator and the hold-down device are carried on a swivel baseplate, together with a motor-driven wire brush for cleaning flux from the locator. This baseplate is arranged to swing the locator and hold-down around the centre line of the heating coil when the blade is reversed and the teeth face in the opposite direction. In addition, the work-coils are adjustable to suit all sizes of teeth and blade diameters. Heating is

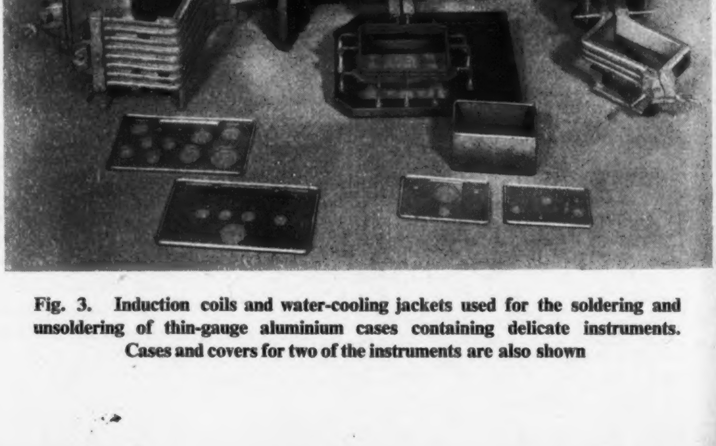


Fig. 3. Induction coils and water-cooling jackets used for the soldering and unsoldering of thin-gauge aluminium cases containing delicate instruments. Cases and covers for two of the instruments are also shown

performed from the under-side of the blade, and full access is thus afforded for loading tips and applying flux from the top.

SOLDERING AND UNSOLDERING INSTRUMENT CASES]

Instrument cases are often soldered with the aid of induction heating, but a recent application of the process is unusual. A particular range of expensive instruments, of a type employed for military purposes, is housed in cases ranging in cross-sectional size from 2 by 4 in. to 6 by 8 in. In addition, some have cylindrical cases up to 4 in. diameter. All cases are made from thin gauge aluminium which is first copper-plated and then tin-plated. The plating is applied to facilitate soldering and permit the use of a non-corrosive flux. End plates in some instances are of cast aluminium and are designed with grooves to receive the sheet-metal cases. These grooves also act as wells for the solder, which is applied pre-formed.

A water-cooling jacket, as seen in Fig. 3, constructed from copper, was made in two hinged sections for each of the instrument cases. It comprises several lines of tubing spaced evenly over the surface to cool the desired areas effectively. The clamps used to hold the two sections of a cooling jacket in place incorporate a locking device and a gear train which ensures that the sides open simultaneously when either is moved. The inside walls of the cooling jacket, although covered in sections with soft felt-like material, are able to absorb heat from the desired areas. Two of the water-cooling jackets, three induction-heating coils, and two cases and covers are shown in Fig. 3.

Pressure is applied uniformly by the clamps, to allow for thermal expansion, and in such a manner as to avoid breakage of the glass window seals in the instruments. Excessive pressure might damage precision gear trains or hermetically sealed drive members. Also, incorrect contact with the cases might result in buckling or damage to the thermoplastics-insulated internal wiring.

The heating cycles for many of these operations are somewhat elaborate, as it was found necessary to apply heat intermittently for periods of approximately 4 sec. " on " and 4 sec. " off," to allow time for the heat to equalize by conduction. These cycles, of course, vary with the individual workpieces.

Unsoldering of these instrument cases for repair purposes had also presented difficulties, particularly as repairs must be carried out at various locations and bases throughout the world. The cases cannot be unsoldered with a torch or iron, due to non-uniformity of heating as well as the possibility of excessive heat being applied by these methods. By following simple procedures, however, unsoldering is now being successfully carried out with the aid of a 10-kW., 450 k.c.s. induction heating generator.

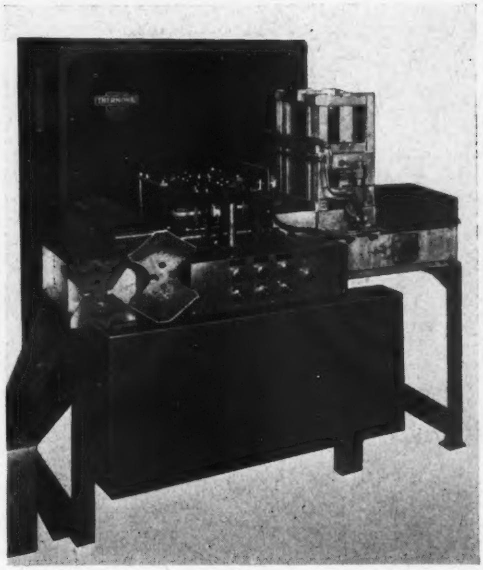


Fig. 4. With this automatic equipment, four portions of a bracket plate for a motor vehicle are annealed simultaneously. Bracket plates of two different sizes can be handled, and the operator is only required to load the magazine

EQUIPMENT FOR LOCAL ANNEALING

Automatic annealing of four sections of a bracket for a motor vehicle affords a good example of the effective use of induction heating. With the previous method, the bracket plates were stacked and a man with a torch heated the required sections. This procedure was simple, but the heating was generally not uniform. In addition, the cost of handling and re-handling the parts was high. Much personal discomfort for the operator was also involved. Moreover, brackets were frequently over-annealed, or annealed beyond the required areas. As a result, some parts cracked, and the over-all rejection rate was high. After the problem had been studied, the machine shown in Fig. 4 was developed, which not only heats the four sections of either of two different-sized bracket plates, simultaneously, but also transfers the parts automatically.

The special tooling was installed on single-position all-steel equipment of unit construction

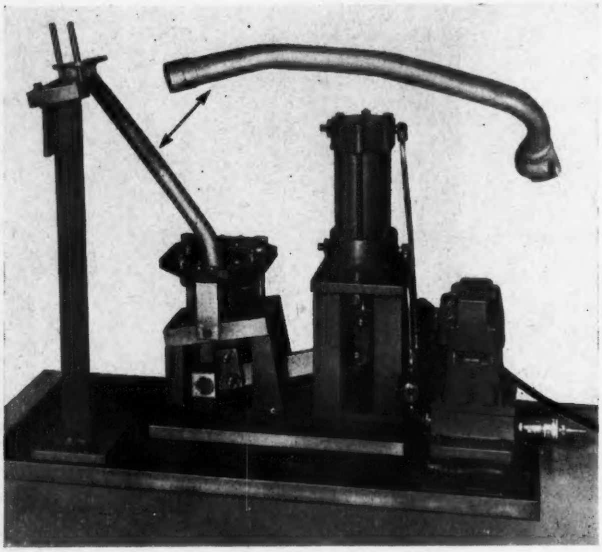


Fig. 5. A typical set-up for induction-brazing fittings to fuel pipes for jet aircraft and missiles. A titanium mandrel, which is expanded in the tube by an air cylinder, serves to spread the filler alloy uniformly throughout the joint

containing all the control circuits and a Ther-Monic radio-frequency, variable-ratio, output transformer, which reduces work-coil voltage to a safe operating value. The coils are connected to a grounded secondary, which also helps to ensure safety for the operator and protects the coils. Another feature of the set-up is a pressure-actuated switch which prevents operation unless there is an adequate flow of cooling water. It may also be noted that flat type leads are employed to permit rapid changing of the induction coils. The steel plates are approximately 7 by 7 in. square by $\frac{3}{32}$ in. thick, and are stacked 20 in. high in the magazine, which is arranged to accommodate plates of either type.

An indexing conveyor withdraws one plate at a time from the bottom of the magazine, and moves it into position in the work-coil, which heats all four areas to be annealed. At the end of each heating cycle, the plate is automatically removed and re-stacked at the base of the table, while another is moved into the heating position. The operators only task is to keep the loading magazine filled.

These plates are of SAE 1020 hot-rolled steel, and the heated area of either part, amounting to approximately 5 sq. in., is raised to a temperature of 1,400 deg. F. The generator employed has a 25-kW. output and the machine anneals 600 pieces per hour and is operated continuously. Among the advantages resulting from the use of this equipment are uniformity of product, absence of scale, increased life of the die employed for the subsequent forming operation, and reduced handling.

BRAZING AIRCRAFT AND MISSILE FUEL LINES

In a modern jet aircraft or missile there are several thousand feet of piping for fuel and other auxiliary systems. The brazing of these pipe-lines often presents problems, since joints must be fluid-

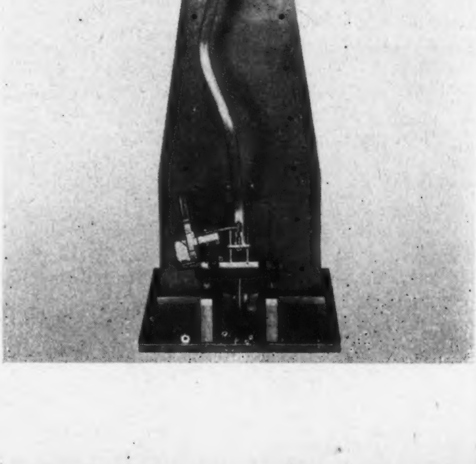


Fig. 6. In this fixture, male and female connectors are induction-brazed to the ends of aircraft fuel pipes. Either right- or left-hand parts can be handled

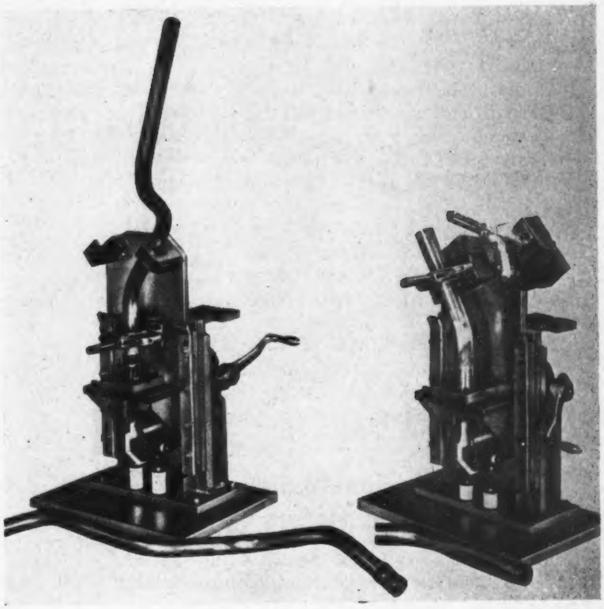


Fig. 7. Each of these left- and right-hand fixtures for induction-brazing fuel-line assemblies incorporates a vertical sliding platen

tight and gas-tight under pressure and/or vacuum. In addition, they must withstand stresses due to vibration, mechanical shock, and temperature changes. As a rule, each joint made must be X-rayed to ensure that the brazing alloy has penetrated 100 per cent. Induction heating is often employed for brazing these joints, and fixtures for various types of fuel lines—both rigid and flexible—have been designed. A typical set-up is seen in Fig. 5.

Joints are first thoroughly cleaned chemically, and flux is applied to all surfaces to be brazed. In this instance, a pre-formed filler-alloy ring is next placed over the tube to rest on the coupling. The assembled joint is placed over an expanding mandrel, and an induction coil (partially seen in the illustration) is positioned around the work. The mandrel is made from titanium, as this metal cannot be brazed by the filler alloy. It is designed to fit freely inside the tube and is expanded by a cone-shaped member which is operated by an air cylinder.

The brazing cycle is as follows: The work-coil is energized, and the coupling being closer to the coil, is heated first and expands, permitting the alloy to flow into the joint by capillary action. When the joint reaches the temperature at which the alloy has its maximum wetting properties, the air cylinder operates and the mandrel expands the tube walls, the alloy thus being spread uniformly throughout the joint area. At the moment the mandrel expands the tube, the work-coil is de-energized, and the joint cools under pressure. All assemblies are radiographically inspected to ascertain whether the alloy has penetrated the entire joint area.

A completed tube assembly, with the joint at the right-hand end, is seen in Fig. 5. For brazing a casting on the left-hand end, expansion of the tube is not required, since the difference in the coefficients of expansion of the two materials results in sufficient pressure between the two members to ensure proper alloy flow.

For another type of fitting, the fixture and induction heating coil shown in Fig. 6 are employed to braze male and female connectors on the ends of the tube. The induction coil has three turns and is designed for low voltage, to avoid the possibility of electrical shorts or danger to the operator. Parts are first chemically cleaned, after which flux is applied, and a ring of silver-brazing alloy (Handy & Harmon Easy-Flo No. 45) is placed on the joint area. After being assembled and placed in the fixture, the workpiece is brazed at one end and turned over. Prior to brazing the second end, a ferrule is clamped in the fixture and the length of the assembly is carefully measured and set. It is thus ensured that the fuel line will be of the correct dimensions to fit the engine. The fixture can be used to braze both right- and left-hand parts without requiring adjustment.

Similar fixtures, also for brazing right- and left-hand assemblies, are constructed, as seen in Fig. 7, with vertical sliding platens, which are manually operated by gearing and racks. The coils, again, are designed for low-voltage operation. For some assemblies, the silver brazing alloy is allowed to flow through the joints. Then, just before the heating cycle ends, the operator twists the ferrule or fitting through approximately 100 deg. to release any gas trapped in the joint. This action also ensures that the brazing alloy has filled the entire joint area. For the same purpose, a vibrator is frequently employed, which is energized before the end of the heating cycle, and de-energized just

before the brazing alloy solidifies. If the vibrator cycle is not correctly timed, a crystallized joint will be obtained.

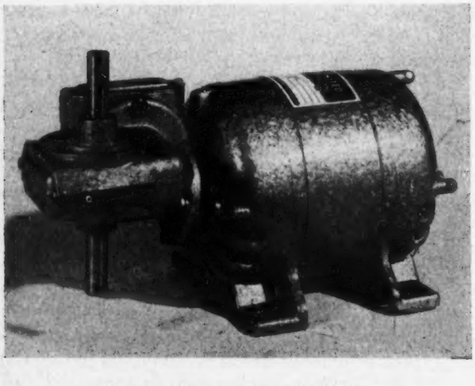
Portable induction-heating units are used by many aircraft and missile manufacturers for brazing fuel lines. Flexible leads extend 20 to 60 ft. from the equipment to enable the induction-heating coils to be applied to the work. Where the workpieces are large, unwieldy, or immovable, mobility of the work-coils is a great advantage.

At the Los Angeles plant of North American Aviation, Ther-Monic remote-operated portable generators, with coaxial cables 50 ft. long, are used to braze fuel lines in B-70 bombers. These dual-output portable units make it possible to bring the heating coils to the work inside the aircraft. The generator, which remains outside the aircraft, can be operated without a water connection.

Comtex Fractional-horsepower Electric Motors

Comtex, Ltd., 566 Cable Street, London, E.1, have introduced a new series of $\frac{1}{80}$-h.p. electric motors which are available for operation on 100/110- and 200/220-volt single-phase supplies, or 400/440-volt three-phase supplies, to provide a speed of 1,400 r.p.m. They can also be supplied with built-on single- or double-reduction gearboxes, and one of the latter is shown in the accompanying illustration. Output speeds to suit requirements can be provided, and the gearbox can be turned in 90-deg. increments to bring the output shaft to the most convenient position.

All motors are supplied for reversing, and a new design of built-in capacitor can be provided as an alternative to the separately-mounted type. Either

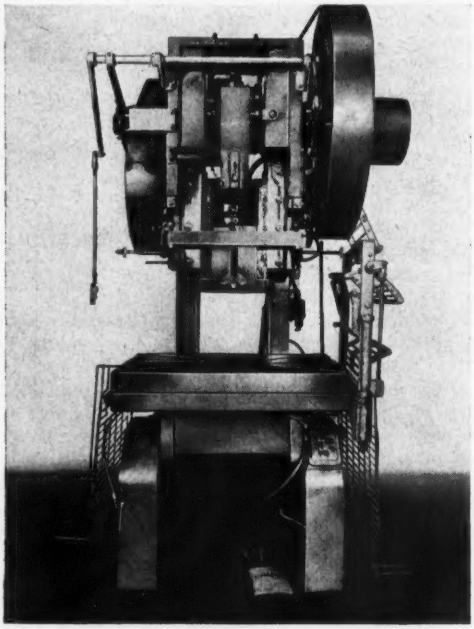


Comtex f.h.p. motor and gearbox

ball bearings or pre-lubricated plain bearings can be fitted, but unless otherwise specified, all geared units have a ball thrust bearing at the gearbox end. Encapsulated windings, which are available as well as the normal Class E, B.S.2757, are impervious to attack by moisture, oil, and most chemicals.

Udal Side-swing Guards

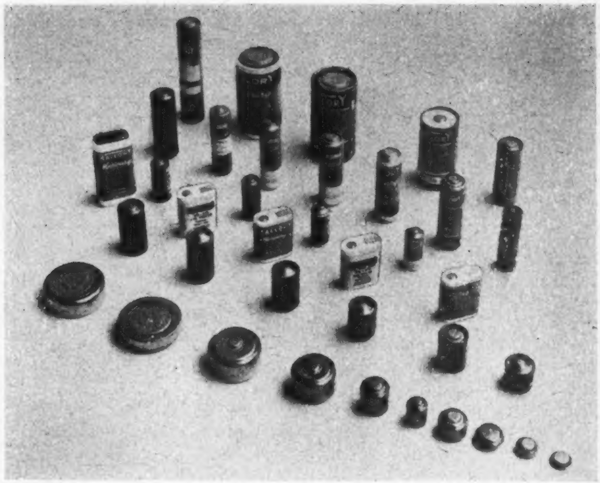
To facilitate tool setting operations on presses of 40 tons capacity and upwards, J. P. Udal, Ltd., Interlock Works, Court Street, Birmingham, 12,



A Udal Fastrip III, air-operated, side-swing type guard is here shown in the tool-setting position

can now supply their Interlock and Fastrip Guards in side-swing type. With this arrangement, as will be evident from the figure, which shows a Fastrip type III air-operated guard, the complete unit is swung away to the side, instead of being lifted up. These guards are necessarily somewhat more expensive than the up-swing type, but it is claimed that they offer considerable advantages, particularly in view of the fact that it may be necessary to move a guard from the operating to the setting position more than once during tool-changing.

Mallory Mercury Cells and Batteries



As is probably now well known, the mercury dry cell battery gives an unusually-high ratio of energy to volume, and it is claimed to yield up to four times the power of other types of batteries of equivalent size. Mercury batteries have a very long shelf life and uniform discharge characteristics without need for recuperation periods, and can operate over a wide temperature range. A British scientist is thought to have discovered the principle of the mercury cell in 1883, but it was not until 1943 that the first battery was made by Dr. Samuel Ruben, in America. Dr. Ruben offered the battery to the U.S. Signal Corps. for use in portable radio communication equipment, and the services of P. R. Mallory & Co., Inc., U.S.A., were enlisted to develop production techniques.

In 1944, the Ministry of Supply decided to adopt the battery for use in "walkie talkie" and other types of Army communications equipment, and a firm known as P. R. Mallory & Co., Ltd., was established at Castlereagh, Northern Ireland. Some three years later, P. R. Mallory & Co., Inc., and the Ever Ready Co. (Great Britain), Ltd., registered Mallory Batteries, Ltd., for the purpose of manufacturing these batteries for the commercial market in this country and production has since mainly been carried on at Dagenham, Essex. In addition to their original applications, these batteries are now used to supply power for hearing aids, a variety of portable transistorized electrical equipment, marine depth sounding units, electronic chronometers and watches, radiation monitors, and medical research appliances such as the heart beat stimulator, and the "radio pill" miniature wireless transmitter. The latter incorporates a mercury cell which is smaller than an aspirin tablet and the whole transmitter is no larger than a threepenny piece, so that it can be swallowed without difficulty. Until recently, mercury batteries have been supplied almost entirely for industrial purposes. With the advent of transistorized equipment in the domestic consumer market, however, it became apparent to Mallory Batteries, Ltd., that it would be necessary to increase production facilities, and accordingly a new factory has been built and occupied at Gatwick Road, Crawley, Sussex. This building covers an area of about 55,000 sq. ft. and a similar amount of space is available for further expansion.

As in other electrochemical cell systems, the electrical energy of the Mallory patented RM. cell is produced by a reaction between the anode and the depolarizing cathode, aided by the alkaline electrolyte. An anode pellet of pure amalgamated zinc of uniform grain size is used, and the cathode pellet consists of high purity mercuric oxide, to which a small amount of micronized graphite, and in some instances electrolytic manganese dioxide, is added. Graphite increases the electrical conductivity of the mercuric oxide, and the manganese dioxide provides added oxygen-giving material. An electrolyte of potassium hydroxide saturated with a zincate separates the two pellets in the cell. Until electrical energy is discharged from the battery, there is no internal reaction since the chemical components possess a high degree of stability and the cell-case components are passive. The nominal cell potential is 1·35 volts.

As will be seen from the line of basic cells at the bottom of the heading illustration, both flat-disc and cylindrical types are produced, which can be made up into the multi-cell batteries shown above, if required. The steel container for the chemicals in the cell comprises an inner cup-shaped case, which is enclosed in an outer slightly-taller case

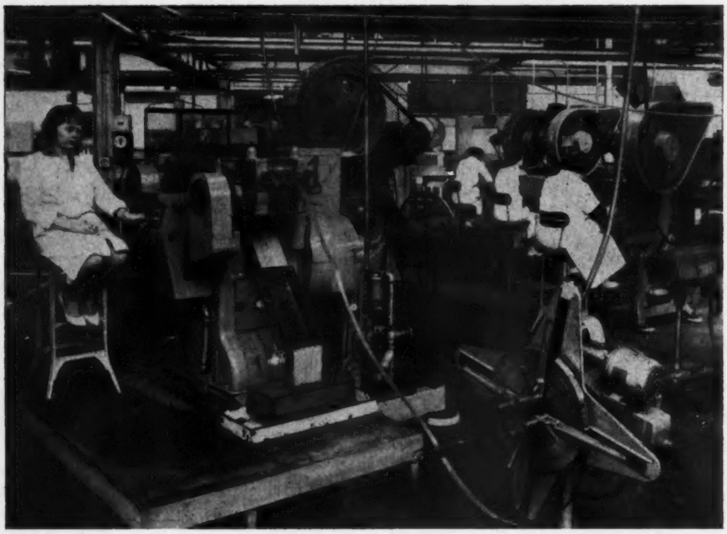


Fig. 1. C.V.A. 25-ton dieing press which is used for the production of cases for Mallory mercury cells

of a similar shape. After the introduction, successively, of the cathode pellet, the electrolyte, and the anode pellet, the opening at the top of the cup is closed by a double steel cap (the negative-cell contact), which comprises two members of inverted saucer shape, encircled by an insulating and sealing ring. These two members are spot welded together on bench type Metropolitan-Vickers units to ensure good electrical conductivity, and the cap and ring assembly is retained by the crimped top edge of the outer case. Between the inner and outer cases, the space is partially filled by a safety sleeve of an absorbent material. Should an excessive amount of gas be produced in the cell, for example, owing to a short circuit, the double cap is slightly displaced upwards against the sealing ring, and venting then occurs in the space between the inner and outer cases. If any of the electrolyte is carried into this space, it is retained by the safety sleeve.

The inner cap member is tin plated to enable a zinc amalgam bond with the anode pellet to be obtained, and the three remaining steel parts—the outer cap, and the inner and the outer cases—are made from nickel-plated strip. This strip is of deep drawing quality and is fed from Humphris stock reels to C.V.A. 25-ton dieing presses. One of these presses with the stock reel on the right is shown in Fig. 1.

Most of the press tools in use were designed and made by the company. A typical multi-stage tool is shown in Fig. 2. This tool produces the inner case for the type 450 cylindrical cell, which is fifth from the right-hand end in the heading illustration. The completed cell is 0·450 in. diameter and is 0·565 in. high, and the case is produced from strip 0·010 in. thick, the C.V.A. press being operated at a speed of 200 strokes per min. A feature of the press tool is that compressed air is employed instead of springs for stripping and ejection. Separate die inserts of tungsten carbide are incorporated, to facilitate servicing without disturbing the

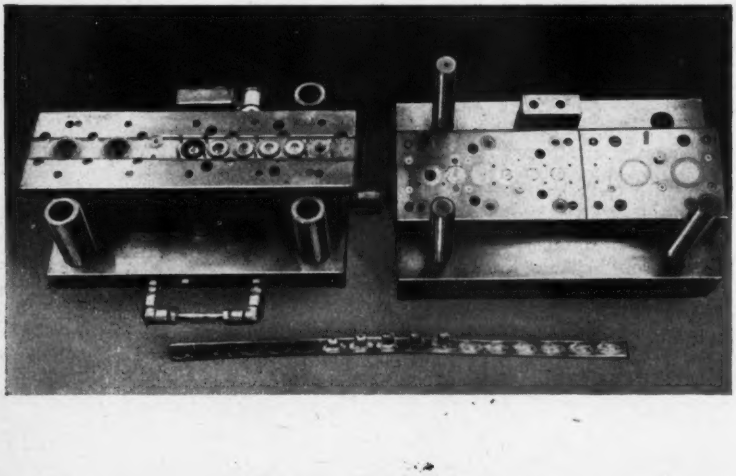


Fig. 2. A view showing the punch and die members of a multi-stage tool for the production of inner cases for cylindrical cells

Fig. 3. This close-up view shows controlled quantities of electrolyte being added to the cells during the final assembly stages

other stages of the tool. At the first stage, two pilot holes are pierced in the scrap metal at the sides of the strip for accurate location at later stations. Stages 2 and 3 provide for cracking operations to permit the components in the strip to move transversely during subsequent drawing, which take place successively at stages 4, 5, 6, and 7. At stage 8, very small vertical ribs are formed in the sides of the component, which is finally severed from the strip at the ninth station.

From the press, the inner cases are taken to the depolarizing room, which is thus described because it houses the Manesty compacting presses that are used to produce the depolarizing cathode pellets for the cells. Each cathode pellet is placed in an inner case, and the assemblies are then loaded into nests in rotary tables on other Manesty presses. The nests are successively indexed to bring them beneath a cylindrical punch which consolidates the pellet to the bottom of each case.

After they have been unloaded, the cases are transferred to an assembly conveyor which travels slowly past female operators, who are seated at both sides. On this conveyor, the cases are put inside the outer members and the safety sleeves are inserted between them. A thin disc of a permeable material is placed on top of the cathode pellet, and is followed by a thick absorbent disc, to which a controlled quantity of electrolyte is added. The process of adding electrolyte to cylindrical cells is illustrated in Fig. 3, and on the bench can be seen the Filamatic liquid dispenser, which is made by the National Instrument Co., Baltimore, U.S.A. Finally, the anode pellets, the sealing rings and the double caps are placed in position, and the cells are again loaded into

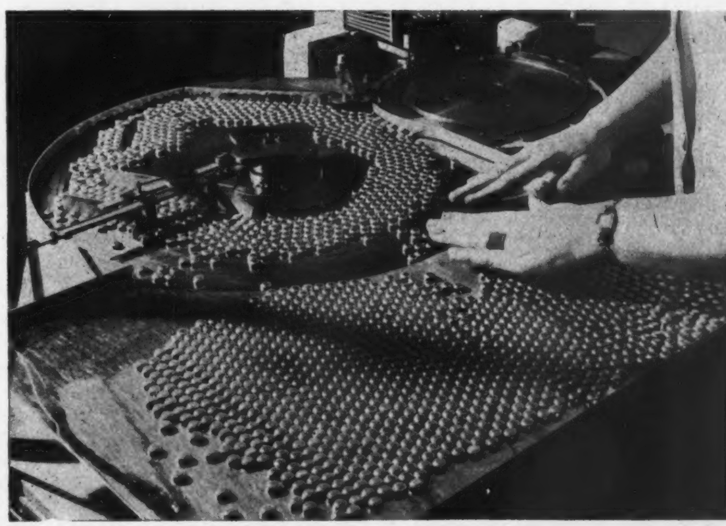


Fig. 4. Cells are automatically subjected to a short circuit test at a rate of over 5,000 per hour on this equipment which has been designed and built by Mallory Batteries, Ltd.

nests on a rotary table. This table is mounted on the bed of a Humphris press, and as each cell is indexed to the working station, the crimping operation is carried out to seal the contents.

Cells are checked with the equipment shown in Fig. 4, which handles them at the rate of 5,000 per hour. The cells in the foreground are slid on to the continuously-rotating plate, whence they are fed, one by one, to nests in the circular table at the right-hand side. Each nest is rapidly indexed to the inspection station where, momentarily, the cell automatically completes an electrical circuit. Cells which do not give the required electrical energy are ejected on to a tray at the rear, and satisfactory cells are discharged into a chute.

Sample cells and batteries are discharged and life tested under a variety of conditions. As an example of the shelf life of these units, it may be noted that a battery with a normal life of 72 hours was discharged after being stored for seven years. Even after this exceptionally long period, the discharge life was found to be still in the region of 63 hours.

Thielenhaus Microfinish Superfinishing Machines

The Microfinish type KW. 3 superfinishing machine for crankshafts, built by Maschinenfabrik Ernst Thielenhaus, Wuppertal-Barmen, Germany, will swing a maximum diameter of 14 in., and can be supplied in three sizes which admit lengths up to 40, 60 and 80 in. between the work-head and tailstock centres. This machine enables superfinishing to be carried out simultaneously on a number of crankpins and journals on the same crankshaft. It is shown in Fig. 1 set up for a crankshaft which has six pins and four journals.

Counterbalanced heads for superfinishing crankpins are connected by swivel links to carrier brackets which are secured to a column at the rear of the fabricated steel bed. With this arrangement, the heads are caused to follow the crankpins when the crankshaft is rotated during the superfinishing cycle. The heads for superfinishing journals are mounted on the top surface of the bed as may be seen more clearly in the close-up view Fig. 2. All the heads can be adjusted for centre distance, so that the machine can be readily set up for handling different crankshafts. The superfinishing stones are held in contact with the work hydraulically, and pressures for individual heads can be varied independently from 22 to 220 lb. per sq. in. Work speeds from 40 to 240 r.p.m. are obtainable, and reciprocating motion is imparted to the work-head spindle at speeds which can be adjusted steplessly from 0 to 80 strokes per min. The machine is designed for operation on an automatic cycle, and different work speeds can be brought into use, if required, under the control of electric timers.

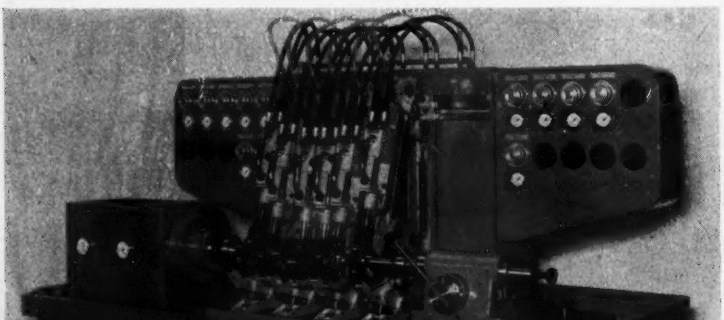


Fig. 1. Thielenhaus Microfinish type KW. 3 machine set up for superfinishing crankpins and journals on a 6-throw crankshaft

As an indication

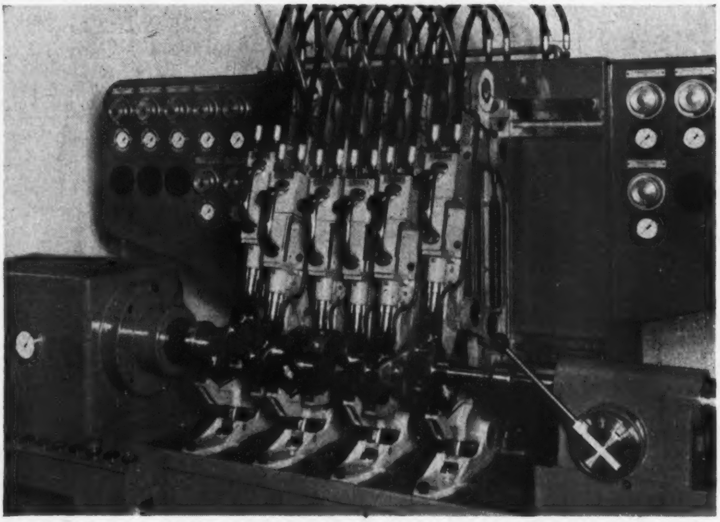


Fig. 2. Close-up view of the Thielenhaus machine shown in Fig. 1

of the productive capacity of the machine, it is stated that six crankpins and seven journals can be superfinished on a crankshaft, to a surface finish of about 5 micro-inches, in a cycle time of 2 to 3 min. Larger machines are built by the company, with capacities for handling crankshafts up to 260 in. long, for marine engines.

SUPERFINISHING BEARING RACES

In Fig. 3 is shown a Microfinish 4-spindle machine for superfinishing raceways for anti-friction bearings, and a close-up view of the work-heads is given in Fig. 4. This machine can be supplied for handling inner races for ball and roller bearings which have bores down to ⅜ in. diameter, and external diameters up to 6 in., also outer races with external diameters ranging from 1 to 9⅞ in.

The work-heads are operated independently, and may be set up for handling races of different diameters, if required. With this arrangement, one or more heads may be stopped for changing the superfinishing stones or the set-ups, for instance, while the remainder continue to operate. Bearing races may be delivered to the individual heads by way of magazine chutes, as shown, and loading, superfinishing, and unloading of the work may then be carried out on a fully-automatic continuous cycle. Alternatively, when only small numbers are to be handled, the races may be loaded by hand, and the individual working cycles started by push-buttons. For setting up, the heads can be operated independently by hand. When one or more of the superfinishing stones have become worn to the maximum permissible extent, or are broken, they are automatically brought clear of the work, and the associated spindles stopped.

With fully-automatic working, the leading bearing race in a chute is advanced into contact with

Fig. 3. Thielenhaus 4-spindle machine for superfinishing raceways for anti-friction bearings

a faceplate on the associated spindle at each operating cycle. It is next automatically centred, and clamps are then tightened on to the end face. For centring, an inner race is located from the bore, and an outer race from the periphery, and since clamping pressure is applied only to the end face, distortion of the work is avoided. When clamping has been completed, drive to the work spindle is engaged and the superfinishing stone is brought to the working position to start the cycle. For superfinishing raceways for ball bearings, the stone assembly is mounted in a trunnion-type holder, as shown, which is oscillated about a horizontal axis to produce the required part-circular shape. At a pre-determined point in the cycle, the spindle speed is automatically increased, and superfinishing is then continued for a period which is pre-set by a time switch. Finally, the spindle is stopped and the clamps are released, whereupon the completed bearing race falls on to a belt conveyor.

With the superfinishing process, a high degree of surface finish is obtained on the work, and any errors in circularity are reduced. The company also builds centreless-type superfinishing machines for handling gudgeon pins and other cylindrical parts by the through-feed method; machines for superfinishing components which have flat, tapered and spherical surfaces; and attachments for mounting on lathes and grinders.

Dorman Machinery Sales, Ltd., Woodside Hill, Chalfont St. Peter, Bucks., are agents for Thielenhaus superfinishing machines in this country.

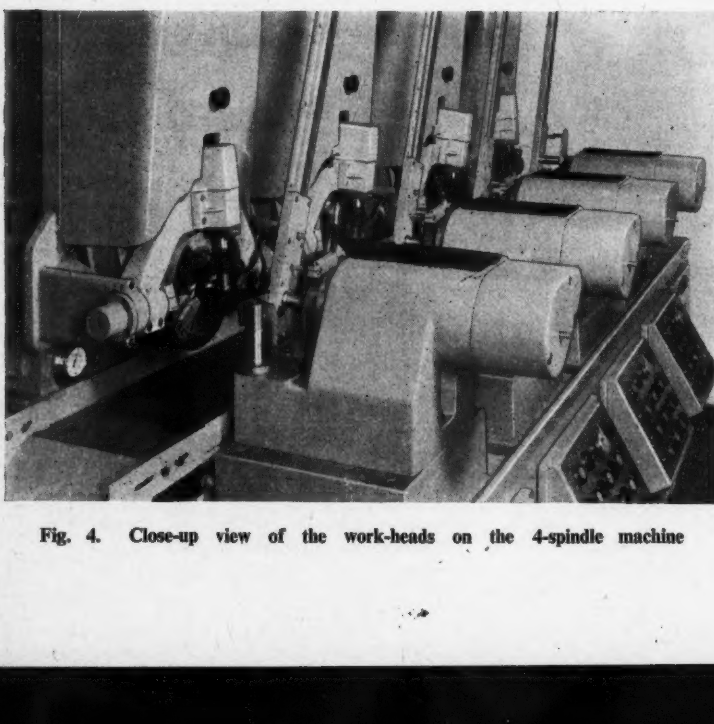
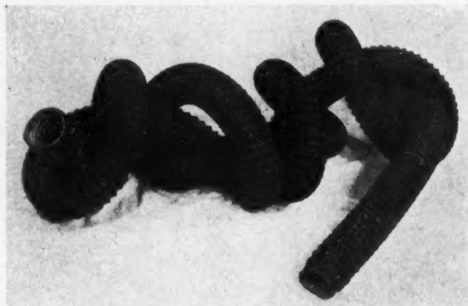


Fig. 4. Close-up view of the work-heads on the 4-spindle machine

Macduct H.D. Flexible Extraction Hose

George MacLellan & Co., Ltd., Shuna Street, Maryhill, Glasgow, N.W., have introduced Macduct H.D. flexible extraction hose in sizes from



Macduct H.D. flexible extraction hose which is available in sizes from 2 to 8 in. diameter in ½-in. steps, also 7 and 8 in. diameter in standard 20-ft. lengths

2 to 6 in. diameter, in ½-in. steps, also in diameters of 7 and 8 in. As may be seen in the accompanying illustration, this hose is extremely flexible, having an inside bend radius of ½ in., without significant loss of cross-sectional area. It is of convolute construction, with an inner ply of $\frac{1}{32}$-in. thick abrasive-resistant rubber, a high tensile steel wire helix, and an outer protective ply of rubberized canvas.

The standard length in which it is made is 20 ft. and the hose is particularly intended for handling grinding dust, wood chips and sawdust, for example, at the usual operating pressures, or at minus pressures down to 20 in. water gauge. It can readily be cut to the required length and connected by ordinary worm-drive clips. If desired, cuff ends can be supplied to suit customers' particular needs.

Producing Components for Box-making Machines

Examples of Finishing Techniques Employed by Vickers-Armstrongs (Engineers), Ltd., Crayford, Kent

By P. A. SIDDERS, Chief Associate Editor

THE PRECEDING ARTICLE IN THIS SERIES* devoted to the activities of Vickers-Armstrongs (Engineers), Ltd., Crayford, Kent, was concerned with milling operations on components for box-making and hardness testing machines. Details of two finishing procedures employed by the company are given here.

Drive to the heads of Empire wire stitching machines, in the range of Vickers-Armstrongs box-making equipment, is transmitted by 9 in. diameter pulleys. The boss of each pulley is 4 in. long and the bore must be finished to 2 in. diameter, +0·001, −0 in. At the initial machining stage, the pulley is first bored, and then reamed to a diameter that is 0·002 in. smaller than the required size.

Subsequently, the bore is finished by rolling on a Ward No. 7 turret lathe, and a close-up view of the set-up is given in Fig. 1. A Rodo (Machine Shop Equipment, Ltd.) tool, as indicated at *A*, is mounted in one of the turret stations. To facilitate loading and unloading the work, the square tool-post normally fitted to the machine has been removed, although the base *B* has been left in position on the cross-slide. Initially, the tool is set to a ring gauge by turning the knurled ring *C*, which advances or retracts a slow-taper plug to expand or contract the rollers. Final setting of the rollers is by trial, to obtain the required finished size for the bore. Once set, the tool needs little further adjustment, and when the information for this article was obtained, the tool had been used for finishing the bores in approximately 350 components without requiring attention.

The rolling tool is mounted in a holder, and is retained therein by the pin *D*. For rolling the bore, the work is run at 508 r.p.m., and the turret is advanced at a feed rate of 76 cuts per in. The tool is fed into the work until the rollers have passed completely through the bore, and the lathe is then stopped. Next, the pin *D* is removed, the turret is withdrawn, leaving the rolling tool in the work, and after the work and tool have been removed from the chuck, the tool is taken out of the bore from the rear end.

SUPERSHEEN BARREL-FINISHING

For finishing many of the components for box-making equipment, the company employs the

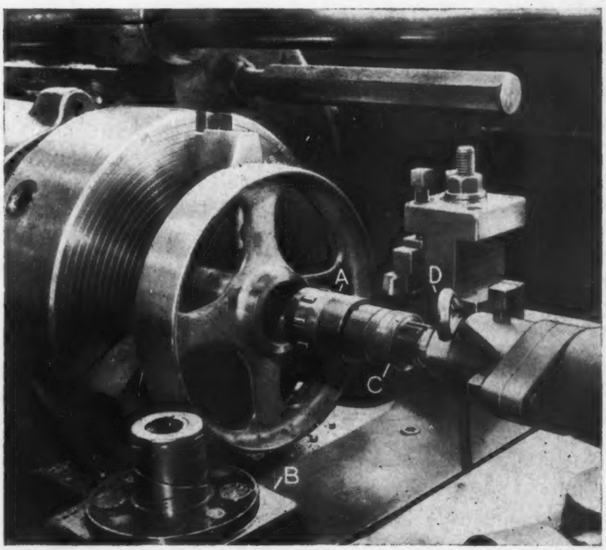


Fig. 1. Set-up on a Ward No. 7 turret lathe for finishing the bore of a drive pulley for an Empire wire-stitching machine, using a Rodo roller-finishing tool

* MACHINERY, 98/1332—14/6/61; 99/292—9/8/61; 99/502—30/8/61 and 99/1004—1/11/61.

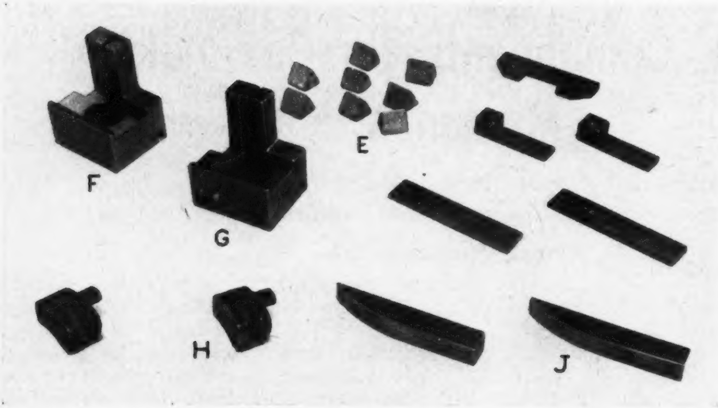


Fig. 2. A selection of components for the Vickers-Armstrongs range of box-making equipment which are finished by the Almco Supersheen process. Synthetic ceramic chips, as seen at *E*, are used

Almco Supersheen process, which was described in MACHINERY, 90/867—19/4/57. This process is handled in this country by Almco (Supersheen Division of Great Britain), Ltd., Bury Head Works, Hitchin, Herts., who supply a range of barrel units, of various sizes, and a variety of finishing media, to suit the size, shape and material of the work to be treated. Vickers-Armstrongs (Engineers), Ltd., have installed a type DBO-1-A machine, which has twin octagonal barrels. Each barrel measures 16 in. across flats, by 8 in. long, and has a capacity of 1 cu. ft.

Fig. 2 shows a typical group of components which are finished in this manner, and the company is continually investigating the use of the Supersheen process for other parts. Pre-formed synthetic ceramic chips are used for the components shown, and, as may be seen at *E*, are of triangular cross-section. At *F* and *G*, respectively, are indicated feeder blocks before and after finishing, and the improvement in surface texture is readily apparent. The staple support *H* has been finished and will subsequently be hardened, whereas the cam *J* has been treated after hardening to impart a smooth surface. Cams are treated for a period of 4 hours, and the Supersheen treatment has enabled a buffing operation to be eliminated.

Chips are loaded into the barrel of the Supersheen machine until it is approximately half full, and then components are added until the charge occupies about two-thirds of the space. The contents are then covered with a mixture of water and a grinding compound, usually Almco Speedicut No. 2, after which the water-tight lid is fitted to the barrel and the drive is engaged. Most components are treated for a period of 6 hours to remove burrs, and then for a further hour with a special compound to obtain a dull polish.

Other components that are Supersheen treated are shown in Fig. 3. At the right are seen cut-off slides, with the untreated part in the foreground. Formers are seen at the left, and it may be recalled that milling operations on blanks for these parts were described in the preceding article. Araldite

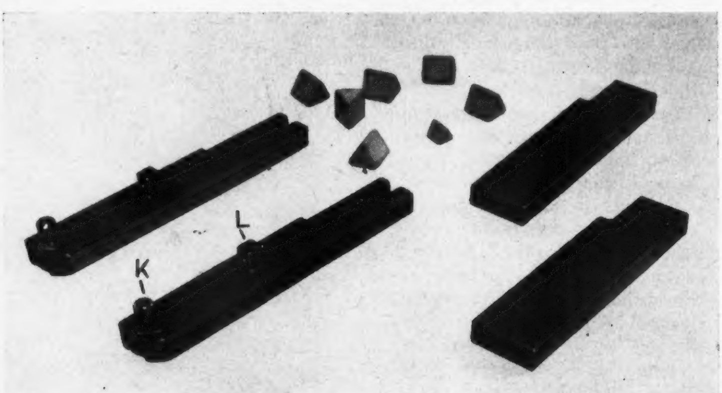


Fig. 3. The Almco Supersheen process is used by Vickers-Armstrongs (Engineers), Ltd., to remove excess Araldite epoxy-based adhesive from the components seen at the left

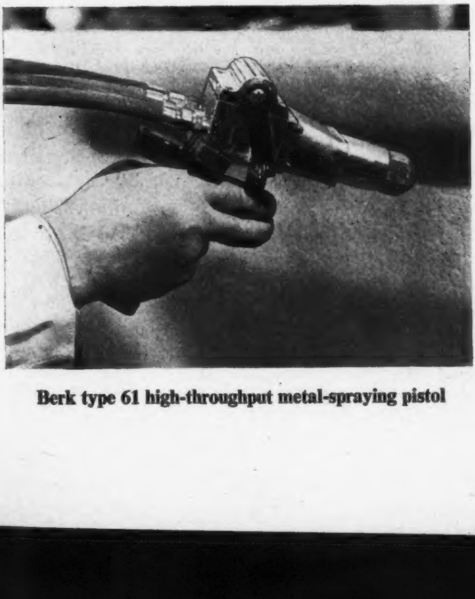
epoxy resin adhesive is now used by Vickers-Armstrongs to secure the pivot *K* and the lug *L*, which were formerly riveted to the main component. The excess Araldite round the pivot and lug are removed by Supersheen treatment, which also imparts a smooth finish generally, as may be seen on the treated part in the foreground. Since each former has a fairly large slot at one end, larger chips are used for the Supersheen treatment than are employed for the parts seen in Fig. 2, since the smaller chips would jam in the slot. The larger chips are seen at the rear of the figure, with a smaller chip for comparison.

High-throughput Metal-spraying Pistol

The Coating Division of F. W. Berk & Co., Ltd., Brent Crescent, North Circular Road, London, N.W.10, have recently developed the type 61 metal-spraying pistol shown in the accompanying illustration. It is stated that it has an hourly throughput of 110 lb. of zinc, with satisfactory deposition efficiency, which enables an area of approximately 450 sq. ft. to be coated to a thickness of 0·004 in. at a total cost of 4d. per sq. ft.

This throughput is achieved by splitting the powder stream into four equal small streams, with which are alternated gas streams. The gun weighs only 3 lb., and the gas, air and powder hoses all enter at the rear to ensure good balance. It is particularly intended for spraying zinc or aluminium on to the cleaned surfaces of heavy beams and plate as used in the shipbuilding and constructional engineering industries, and the only control provided is a spring-loaded trigger which operates remote valves for the gas and air supplies.

Powder for the gun is fed from an easily re-charged container of 2 cwt. capacity. The powder supply is cut off at the feeder when the trigger is released, to prevent any build up in the powder line to the gun.

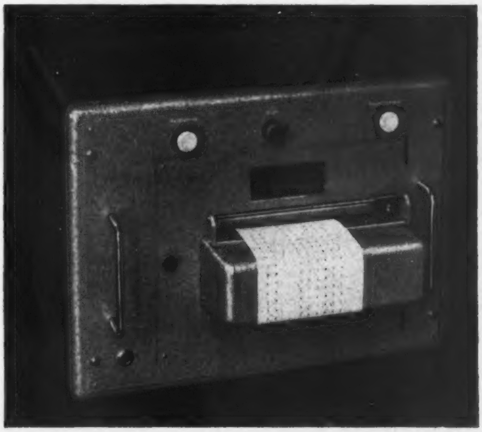


Berk type 61 high-throughput metal-spraying pistol

Since the powder is split up into four individual streams, each surrounded by a gas flame, the cross section to be heated is relatively small. As a result, only 95 cu. ft. per hour of oxygen, and 27 cu. ft. per hour of propane, are required.

Wetzer Printing Equipment

General Precision Systems, Ltd., Bicester Road, Aylesbury, Bucks., are the sole agents in the United Kingdom and Commonwealth for the range of electro-mechanical printing equipment made by Hermann Wetzer K.G. Bavaria, West Germany. These instruments are suitable for use as recording devices in connection with established methods of counting, and they can also be employed for logging other kinds of data.



A typical Wetzer electro-mechanical printer

Because the instruments are assembled from prefabricated parts, it is possible to adapt the printing elements to any specific requirements. Both the counting units and the type wheels are available in groups of 2, 4, 6, or 8, and may be arranged to print at a maximum speed of two lines per sec. The accompanying illustration shows a typical printer consisting of two groups of type wheels, one of two digits for counting consecutive numbers, and one of six digits. Three of the latter group are operated by parallel inputs, and three by serial inputs. The printers can be supplied as table models, or for mounting in standard 19-in. racks.

Consolidated Pneumatic Radial Drilling Equipment for Producing Van Frames for British Railways

AT THE EARLSTOWN WORKS of the Midland Region of British Railways, more than 800 general utility vans of a new type provided with end-loading doors, and capable of rapid conversion to parcels freight, have recently been completed. Each van measures 37 ft. over headstocks, and has a wheel-base of 19 ft., and a load capacity of 10 tons. Production was undertaken at the rate of 14 units per week, and the vans were built on two assembly lines after completion of the principal pressing and drilling operations.

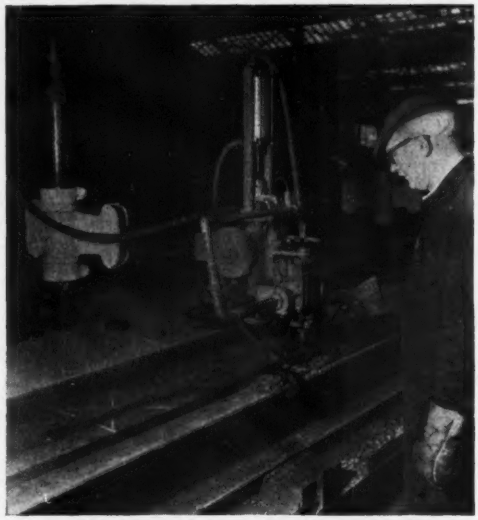


Fig. 2. Close-up view of one of the Consolidated Pneumatic type 327 drills employed for operations on railway van frames

The preliminary fabrication was concerned with the two centre longitudinal members and two sole bars which are the main portions of each frame structure. Each of the longitudinal members consists of a T-section and an angle section welded together, the material being cut to length by means of two machines set at 40-ft. centres on the shop floor, and fitted with 20-in. diameter, Universal, resin-bonded cutting-off wheels. After they had been cut, these sections were given a $\frac{3}{8}$-in. camber and were then set up in a jig and joined by intermittent hand welding, the spaces between runs providing for the accommodation of other welded sections at later stages.

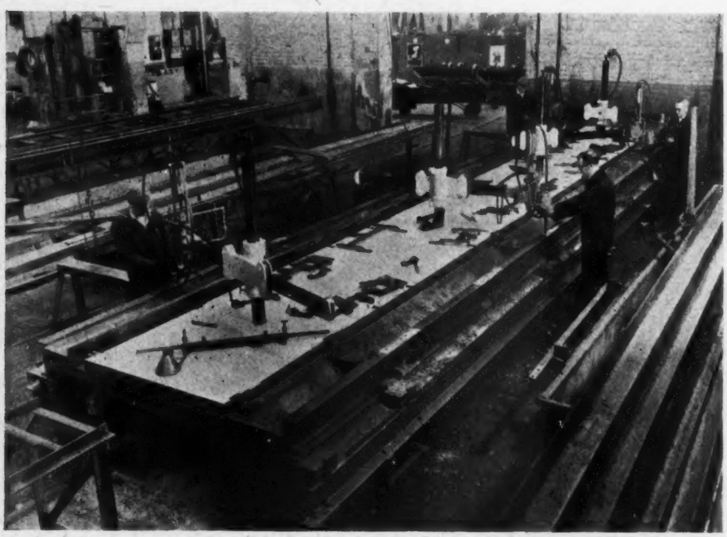


Fig. 1. A general view of the drilling rig for railway van frames with Consolidated Pneumatic type 327 drills mounted on sliding radial arms

When this operation had been completed, the sections were transferred to the main drilling stations, as seen in Fig. 1, where about 100 holes ranging from $\frac{5}{16}$ to $\frac{15}{16}$ in. diameter were drilled in each set of centre longitudinal members, also two holes of $1\frac{3}{8}$ in. diameter for electrical conduits. The design of

the equipment used to enable drilling to be performed economically was the result of collaboration between British Railways staff at Earlstown, and the Consolidated Pneumatic Tool Co., Ltd., 232 Dawes Road, London, S.W.6.

Four Consolidated Pneumatic type 327 drills were mounted on sliding radial arms, 7 ft. long, and fitted with 6-in. stroke double-acting air feed cylinders, as seen in the close-up view, Fig. 2. The drills were so located as to enable every hole to be reached. With this equipment, handling problems were reduced to a minimum, and two 10 cwt. chain block hoists sufficed both for loading and turning the components on each side of the rig. The drills employed were taken from the normal stock of power tools maintained at the works.

Consolidated Pneumatic power tools were also employed for many other operations involved in the production of the vans, including type 40 riveting hammers for securing step brackets, and Hicycle electric tools, such as screwdrivers for fixing the roof lining with self-tapping screws, wood drills, augers and nut runners.

Disposal System for Aluminium Chips

At the works of the Boeing Airplane Co. at Wichita, Kansas, U.S.A., large quantities of aluminium chips are produced during milling operations on components for the B-52H ballistic missile bomber, which include spars and skin sections up to 80 ft. long. Chips from certain of the milling machines are collected by suction equipment close to the cutters, and discharged through gratings into tunnels below the shop floor. Other machines are provided with spiral conveyors which carry the chips to collection points whence they are delivered to the tunnels. In addition, chips are transported from some machines which are not directly connected to the system, and discharged by way of large funnels.

The tunnels are about 3 ft. wide and 5 ft. deep, and at the bottoms there are sluiceways of welded steel construction, as seen in the illustration. Fluid comprising one part soluble oil to 30 parts of water, which is also used as coolant on the machines, flows along the channels and carries the chips to a central recovery plant. The total length of the sluiceways is 2,250 ft., and fluid from an 80,000 gal. supply is circulated at the rate of 12,000 gal. per min. For this purpose, four pumps, each of 6,000 gal. per min. capacity, are provided, two of which are operated at a time.

From the central channel of the system, the liquid carrying the chips flows into a large revolving drum with walls of perforated stainless steel sheet. Baffles in the drum deposit the chips on a conveyor belt which passes through the centre, and they are thence transferred by bucket elevators to crushers. After they have been crushed, the chips pass to a high-speed centrifuge dryer, and are finally delivered by way of another bucket elevator to storage bins. Hoppers in the floor of these bins are at such a height that lorries can be driven beneath them, into which the chips are discharged by gravity.

For the removal of sludge and fine chips from the fluid, settling tanks and skimming devices are provided, and there is a 1,500-lb. magnet for the extraction of ferrous particles. Final purification, in readiness for recirculation, takes place in a battery of six cyclone centrifuges. The coolant is delivered through pipes which are installed in the tunnels, as may be seen in the figure.

All the recovery plant is automatic in operation, and the installation is tended by one man. The system was designed by Wilson & Co., Ltd., Salina, Kansas.

A view in one of the tunnels. The sluiceway along which the chips are carried by fluid flow is on the left

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Craven H.B.F.6 Horizontal Boring and Milling Machine

Improvements have been made recently to the H.B.F.6, travelling-column, horizontal boring, facing, milling and drilling machine built by Craven Brothers (Manchester), Ltd., Vauxhall Works, Reddish, Stockport, Cheshire, which is intended for use in conjunction with a T-slotted floor plate, and the latest design is shown in Fig. 1.

The 6-in. diameter spindle is mounted in the boring head in ball and roller bearings at each end, and it can be traversed axially for a maximum distance of 48 in. at one setting, a total travel of 72 in. being obtainable in steps. Capable of

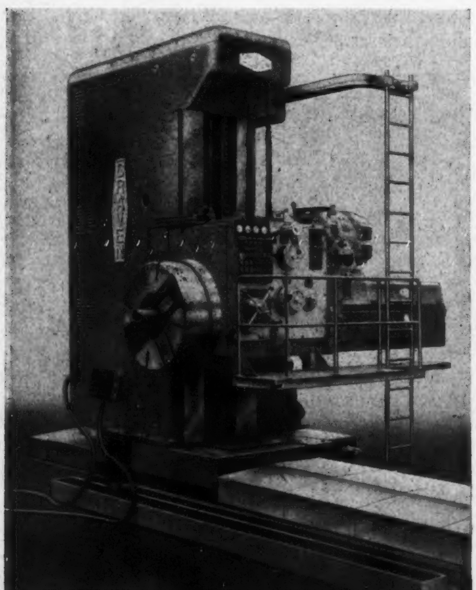


Fig. 1. Craven H.B.F.6 floor plate-type, travelling-column, horizontal boring and milling machine

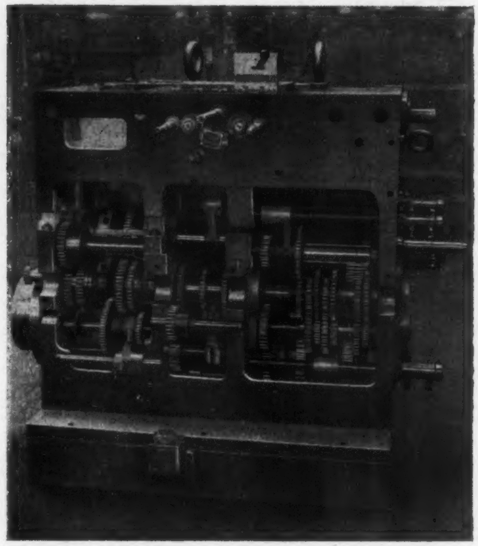


Fig. 2. For this close-up view, covers have been removed from the front of the boring head, to expose the gearing whereby drive is transmitted to the spindle, facing head, and feed motions

machining diameters up to 60 in., the 42-in. diameter facing head is carried by a sleeve, which is mounted in ball and roller bearings at the front and an adjustable plain bearing at the rear. Main drive is taken from a 20-h.p. variable-speed reversing motor at the rear of the boring head, and is transmitted through 3-speed gearing and thence by way of separate systems to a sleeve gear keyed to the spindle and a spur gear which meshes with internal teeth on the facing head. Speeds from 20 to 492 r.p.m. and 2·5 to 62 r.p.m. are obtainable, independently, for the spindle and the facing head, and if required, these members can be driven simultaneously, at speeds in the ratio of 8 : 1.

Feed drive is taken from one of the shafts in the transmission to the spindle, and a total of 18 rates can be obtained, ranging from 0·0007 to 0·25 in. per rev. of the spindle for boring and 0·001 to 0·4 in. per rev. of the head for facing, also rapid power traverse for both motions. Feed is imparted to the spindle by duplex screws and nuts, which are connected to a sliding thrust block, and to the facing head slide through differential gears. There is provision for automatically disengaging feed to the spindle when a predetermined depth has been reached, and equipment is incorporated to enable screw threads with three specified pitches

to be cut without the need for change gears. In addition, by using change gears, threads from 2 to 22 per in. can be cut. The drive and feed gearing to the spindle and the facing head is housed in the boring head, as may be seen in Fig. 2. In this illustration, covers at the front of the head have been removed. Fine and coarse hand adjustments are applied to the spindle and the facing slide by means of a star wheel, and this wheel also provides for adjusting the entire facing head and sleeve assembly axially through a distance of 3 in. After it has been set, the sleeve is clamped by a hand-operated system.

The boring head is counterbalanced by weights inside the column, and it has a vertical traverse of 6 ft., the minimum distance between the spindle axis and the bed being 28 in. Normally, the column saddle can be traversed through a maximum distance of 10 ft. along ways on the bed, but provision is made for extending the latter, to enable a longer traverse to be obtained. The bed-ways are protected by telescopic metal covers, and the sliding surfaces of the saddle are provided with wear-resisting plastics inserts. Milling feeds from 0·5 to 25 in. per min. are available vertically and horizontally, and drive for these motions is taken

Fig. 3. Drive for the vertical and horizontal milling feed motions is taken from individual motors, mounted on the column saddle, as here shown

through independent multi-speed gearing systems from separate 5-h.p., variable-speed, reversing motors, which are mounted on the saddle, as shown in Fig. 3. Movements can be applied simultaneously in both directions, to facilitate the machining of irregular surfaces. Rapid power traverse is available, and vertical and horizontal hand adjustments are effected by means of a second star wheel.

Particular attention has been paid in the design to ease of operation, and the controls are grouped together on the boring head, to which is attached a platform for the operator. Speeds and feeds are selected by means of dials, and there are indicator dials to show the milling feeds in use. A tachometer is provided, to indicate the spindle and facing head speeds, and there is also an ammeter, to show the load on the driving motor. The various motions available are obtained—and the direction of travel determined—by magnetic clutches and solenoid-operated hydraulic equipment, and during the progress of an operation, the machine is controlled by means of duplicated sets of push-buttons and selector switches, arranged on the boring head and on a separate, transportable, floor-mounted unit. Buttons in these sets also provide for the operation of hydraulic clamps, for securing the facing head, spindle, boring head, and column saddle. Pressure fluid for the hydraulic systems is supplied by motor-driven equipment housed in the boring head and in the column saddle, and the electrical equipment is housed in a cabinet at the rear of the column. Graduated scales on the bed and the column are observed through "microptic" readers, for accurately setting the saddle and the boring head, and a telescope is provided to enable the reader on the former member to be observed from the platform.

All the gear compartments, and the column and bed-ways, are automatically lubricated, and motor-driven coolant equipment is provided. Additional items which can be supplied include a transportable unit for supporting the outboard end of a boring bar, which has power-operated horizontal and vertical adjustment; and an 8- by 8-ft. self-contained, transportable rotary table.

MOULDED POLYTHENE TUB.—Thermo Plastics, Ltd., Luton Road Works, Dunstable, Beds., are now marketing a heavy duty tub of 40 gal. capacity, injection moulded from black polythene. This tub, which is provided with lifting handles, weighs 15 lb., and is intended for the handling and storage of materials to be mixed or compounded. The polythene is resistant to a wide range of chemicals, cannot be dented by impact, and is easily cleaned.

Berardi Special-purpose Machine Tools

THE PRODUCTS OF Officine Rino Berardi, Brescia, Italy, include special-purpose, high production machine tools incorporating unit heads for performing milling, facing, boring, drilling and tapping operations. These heads have hydraulic feed motions and they are made in three ranges designated OA, OB, and OC. In the single-spindle OA range there are five sizes of head, and in the OB and OC multi-spindle ranges, which are identical as regards capacity, there are four sizes. The OB heads are equipped with adjustable spindles, designated type B, and the OC heads with slip spindles which are carried in a jig-bored plate and are known as type C.

Spindle drive motors from 1 to 20 h.p. are incorporated in the OA heads, which have maximum drilling capacities ranging from 0·7 to 4¾ in. diameter in steel, according to size. Various drive arrangements can be provided depending upon the duty, including belt transmissions with change pulleys with or without back gears. Two-speed motors provide further speed changes and spindle speeds as low as 25 r.p.m., and up to 1,616 r.p.m. can be obtained. The smallest head in this range is available with slide base only, but the larger sizes can also be supplied with beds for floor mounting.

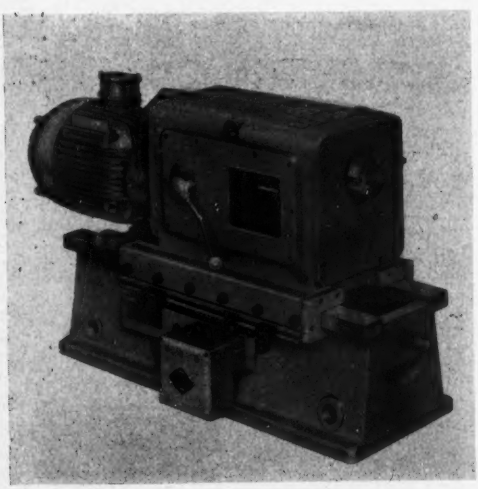


Fig. 1. Berardi type OAI single-spindle unit head with gear changes for spindle speeds, and steplessly-variable hydraulic feeds

Head travels range from 4¾ in. to 23⅝ in., and the radial strokes of facing tool-heads from 1⅜ to $3\frac{9}{16}$ in. Steplessly-variable feeds rates range from 0·6 to 17¾, or, if desired, 0·4 to 10 in. per min. The pump motors for the feed and rapid traverse motions are of 1 to 4 h.p.

A type OAI unit head is illustrated in Fig. 1. It has a drilling capacity of 30 mm. ($1\frac{3}{16}$ in.) diameter, and the 2½-h.p. flange-mounted motor drives the spindle through sliding gears which provide 4 speeds in any of the following ranges, 113 to 904 r.p.m., 145 to 1,160 r.p.m., 182 to 1,456 r.p.m., or 202 to 1,616 r.p.m. The forward and return rapid traverse strokes, and the feed stroke are determined by the setting of trip dogs which actuate precision micro-switches. Dead stops are provided for use when facing and undercutting operations are to be performed.

The four sizes of OB and OC multi-spindle heads have drilling areas of 7·9 by 11·8 in., 13 by 18½ in., 16⅛ by 25·6 in., and 21⅝ by 39·4 in. The maximum number of spindles that can be fitted ranges from 12 to 40 according to the size of the head and the diameters of the holes to be drilled. Spindle driving motors from 4·5 to 20 h.p. are provided, and as an example of capacity, 40 holes of 14 mm. (0·55 in.) diameter can be drilled with the largest head in the range. Eight spindle speeds are obtainable by means of change pulleys and a 2-speed motor, the ranges for the four heads being 150 to 1,885 r.p.m., 125 to 1,330 r.p.m., 130 to 1,260 r.p.m., and 160 to 1,000 r.p.m. The head travels for the four units are 10⅝ in., 15¾ in., 17¾ in., and 28⅜ in., and the steplessly-variable rates range from 0·59 to 17¾ in. per min. If desired, a lower range, from 0·4 to 9·8 in. per min., can be provided.

Slip spindles and adjustable spindles in 11 sizes are available which permit holes to be drilled at minimum centre distances from 0·7 in. to 3 in. and have axial adjustments up to 0·79 in. A No. 0 Morse taper is provided in the nose of each of the two smallest spindles, No. 1 in the third size, and parallel bores in the remainder, which accommodate sleeve-type tool-holders of various lengths and with Morse tapers ranging from No. 1 to No. 4. Slip spindles for more than one hole pattern can be incorporated in a jig-bored plate, and if the number exceeds that of the driving spindles available quick-acting couplings can be provided on the universal joint shafts to permit rapid change over. Also, the number of spindle positions can be in-

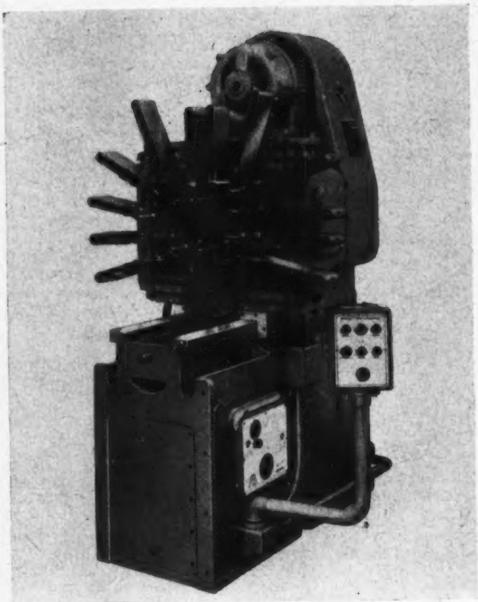


Fig. 2. Berardi type OB horizontal drilling unit with multiple, adjustable spindles

creased by driving one spindle from another. Spindles with axially-floating tool-holders are available for carrying out tapping operations. A type OB head on a floor-mounting side base, and equipped with 12 adjustable spindles, is shown in Fig. 2.

Other units in the company's range include rotary indexing tables which are available in hand and hydraulically-operated types. The hand-operated tables, known as type TG, are made with diameters of 13¾, 20½, and 27½ in. They can be supplied with any number of index positions up to 12, and the accuracy of location is claimed to be within ±5 sec. When the clamping lever is released, the table is lifted slightly from the base so that it moves quite freely on the thrust bearing. If desired, the index locating mechanism can be disengaged by turning a knurled knob.

The hydraulically-operated automatic indexing tables, designated type G, are made in seven sizes ranging from 13¾ in. to 78¾ in. diameter, the four largest tables being provided with built-in pump units. Seperate pump units are supplied for the smaller tables, and the electrical controls for all sizes are contained in separate cabinets. For tables of greater diameter than 27½-in., a device can be supplied for automatic selection of the number of index positions required. The electrical controls can be interlocked with the automatic work cycles of vertical drilling and tapping machines, or special-purpose rotary transfer machines.

In Fig. 3 is shown a 3-way machine equipped with a type G, 20½-in. diameter, indexing table for machining cast-iron bodies for wedge gate valves. The operations comprise scroll turning the outside face of each flange, facing the top to receive the cover, and machining the two sealing ring grooves at an angle in the inside web. At the first stage, the right-hand head scroll-turns one flange face while a sealing ring groove is being machined by the left-hand head, which is set over at the required angle. The third head, at the rear, faces the casting to take the top cover. Scroll-turning is performed with a relatively coarse feed, the object being to provide a surface which, in conjunction with the packing employed, ensures a fluid tight joint in the pipeline.

Fig. 3. Berardi 3-way machine with type OA unit heads and a type G520 rotary table for performing, in two stages, flange-facing, top-facing, and sealing-groove turning operations on wedge gate valve bodies

Upon completion of this stage, the table is automatically indexed through 180 deg., and the opposite flange is scroll-turned and the second sealing ring-groove is machined with the left-hand spindle head indexed to the opposite angular position. The rear head, during this stage, is inoperative. Valve bodies from 2 to 6 in. bore can be handled on this machine, and the floor-to-floor time for a 4-in. valve is approximately 6 min., so that an output of 8 pieces per hour is obtained at 80 per cent efficiency.

Another 3-way machine is shown in Fig. 4, the workpieces in this case being cast-iron mounting blocks for refrigerating units. These blocks are held on a 5-station type G 700 automatic indexing table of 27½ in. diameter, each fixture accommodating two castings. The left-hand and right-hand horizontal heads are type OC slide-base units each equipped with two spindles, and the vertical head is provided with slip spindles, in a carrier plate, the arrangement being similar to that of the firm's VB range of vertical drilling machines, to which reference will be made later.

The work fixtures are hydraulically operated, and at the first station a deep hole of ⅜ in. diameter is drilled in each of the two castings from the left-hand head. For this operation, the feed motion is controlled by a timer which causes the head to retract for swarf clearance at intervals during the drilling stroke. In addition, a hole in the top of each workpiece is rough counterbored by spindles on the left of the vertical head. At the second station, two holes of $\frac{5}{32}$ in. diameter, counterbored $\frac{3}{16}$ in. diameter, one hole of 0·110 in., and another of 0·116 in. diameter are drilled in the two castings also by spindles on the left-hand side of the vertical head. Holes of the same sizes, but in opposite hand positions, are drilled in the two castings at the third station, by spindles carried on the right-hand side of the vertical head. Finally, at station (4), the counterbored hole is finish bored with the

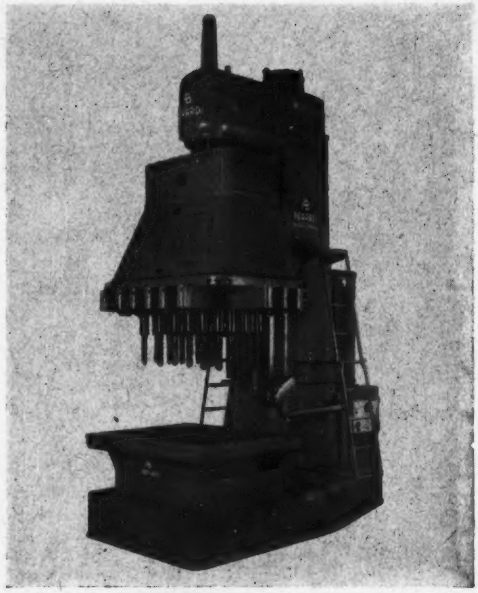


Fig. 5. Berardi type VB IV vertical drilling machine with multiple, adjustable spindles and automatic hydraulic feed cycle

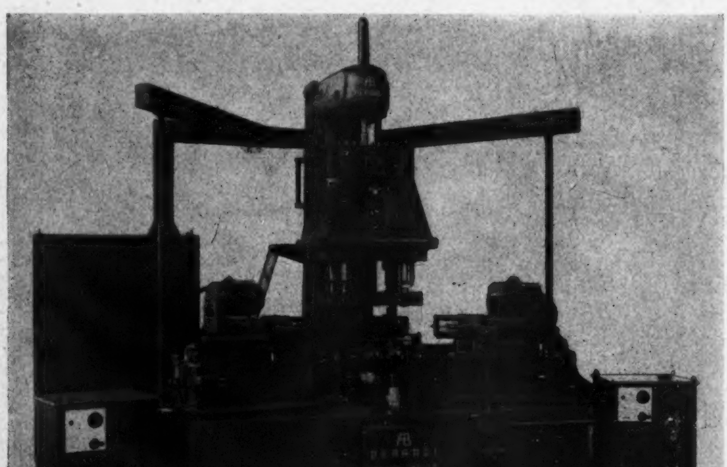


Fig. 4. Berardi 3-way machine for performing drilling, boring and counterboring operations on mounting blocks for refrigerating units. Type OC unit heads are incorporated

vertical head, and a deep ⅛-in. diameter hole is drilled in each casting by the right-hand horizontal head, again by the step-by-step method, with timer control, for clearance of cuttings.

Safety electrical devices ensure that the machine is stopped should the table not be correctly indexed and locked, or if the spindle heads have not returned to the starting positions. A total of 21 h.p. is needed to drive the machine, and at 80 per cent efficiency the output is 150 pieces per hour.

The range of vertical, hydraulic-feed drilling machines made by the company includes the single-spindle type VA which is available in capacities of 1¼, 2¾, and 4⅜ in. diameter in steel, the multi-spindle type VB fitted with adjustable spindles from the B range, and the type VC, with slip spindles from the C range, which are carried in jig-bored plates. Multi-spindle machines, designated type VD, with spindles at fixed centres, and type VE, with adjustable, fine-boring spindles, are also available. Each of these machines is made in three hole capacities and with two sizes of driving motor for light or heavy duty. A type VB IV Z adjustable multi-spindle machine with box table is shown in Fig. 5. Machines with knee-type tables, cross-traversing and longitudinal-traversing tables, and hand- or hydraulically-operated rotary indexing tables can be supplied.

The electro-hydraulically controlled vertical machines and the horizontal drilling units can also be equipped with axially-floating tap-holders or spindles with leadscrew control, for performing tapping operations.

Officine Rino Berardi were established in 1930, and at present employ approximately 250 workpeople. The Brescia works has a floor area of about 60,000 sq. ft., and includes a jig-boring and test room in which automatic air-conditioning is provided, and the temperature is maintained at 20 deg. C., ±1 deg. The agents for Berardi machines in this country are Herbert Widdowson & Sons, Ltd., Canal Street, Nottingham.

Cardeflex and Elsi Flexible Couplings

J. H. Fenner & Co., Ltd., Marfleet, Hull, are the sole distributors in the United Kingdom and the Commonwealth for the Cardeflex and Elsi flexible couplings of patented design made by Hochreuter & Baum Maschinenfabrik, Ansbach/Mittelfranken, West Germany. The Cardeflex couplings, an example of which is shown in Fig. 1, are made in a standard range from 2¼ in. to 10 ft. 4 in., outside diameter, the latter transmitting 90,000 h.p. at 330 r.p.m. The maximum speed for couplings with cast-iron flanges is 6,000 r.p.m., but steel flanges can be supplied for higher speeds.

These couplings are of all-metal construction, the drive being transmitted through the coil springs *A*. The latter bear at one end on pivoted abutments *B*, on one flange of the coupling, and at the other end, on similar abutments *C*, which are engaged by driving pins *D* in the other flange. There are four ranges of Cardeflex couplings, and the numbers of springs vary from 6 to 12.

In addition, there is a cardan shaft type with steel flanges, of diameters ranging from 3⅝ to 19⅞ in. Special couplings to customers' requirements can also be supplied, for example, incorporating a brake drum or flywheel, or with provision for sustaining end thrust. The standard range of couplings permits a maximum torsional deflection of ±5 deg. but special couplings are obtainable, to give ±10 deg. An angular misalignment of 2 deg. can be tolerated, also end float up to a maximum of 5 per cent of the outside diameter.

The Elsi couplings have safety slipping features, in addition to the flexible spring drive arrangement of the Cardeflex range. They can be set to

Fig. 1. A view of the two halves of a Cardeflex coupling, showing the springs and driving pins

slip at any torque up to full capacity, and the drive is taken up as soon as the torque falls below the set value. These couplings are available in a standard range of four types, covering torque capacities from 26·9 lb.-ft. to 85,000 lb.-ft., and have outside diameters from 6⅛ in. to $55\frac{5}{16}$ in.

A sectional drawing of a C/A coupling is shown in Fig. 2, this type being made in diameters from 13 to $55\frac{5}{16}$ in. The two sets of driving pins *E* and *F* are carried in brake cones *G* and *H*, which are provided with friction surfaces that engage the bore of the double-tapered casing *K*, attached to the coupling flange. These surfaces are held in contact with the casing bore by means of coil springs in the hollow driving pins *E*, which urge the two cones apart. The pressure can be adjusted by means of end screws, as at *L*, and graduated rods indicate the slipping torque.

The C/B couplings are of similar capacity but each has an external boss on the flange which carries the cone *K*. Couplings in the N/1 range are of the same design as the C/A type, but have torque capacities from 103 to 1,244 lb.-ft., and overall diameters from $8\frac{11}{16}$ to $17\frac{13}{16}$ in. The smallest couplings (type N/2) for torques from 26·9 to 78·6 lb.-ft., have a somewhat simpler, metal-to-metal friction cone arrangement.

Attention is also drawn to the Elsi-Hydrostar coupling shown in Fig. 3, which incorporates all the features of the Elsi coupling, and, in addition, can be de-clutched hydraulically. Each of the spring-loaded pins that hold the brake cones against the casing incorporates an oil cylinder *M*, and when oil under pressure is introduced, the spring is compressed, and the cones are freed from the casing. Oil is delivered through one of the shafts, and by way of the feed pipe *N* and the annular pipe *P*, to each cylinder. Rotary seal connections for use at the ends of the shafts are available. The rating for a Hydrostar coupling is approximately 0·7 of that of the equivalent size of an Elsi coupling.

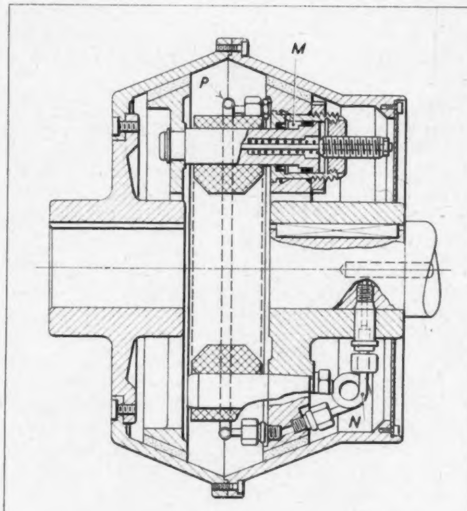


Fig. 3. Sectional drawing of an Elsi-Hydrostar flexible and slipping coupling which can be de-clutched hydraulically

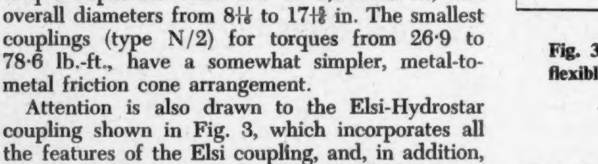


Fig. 2. Sectional drawing showing the construction of a type C/A Elsi flexible and slipping coupling

AUTOSET DUTHANE-TYRED WHEELS FOR CASTORS.—Autoset (Production), Ltd., 76-82 Stour Street, Birmingham, 18, have introduced Duthane tyred wheels in sizes from 3 to 24 in. diameter, which can be mounted in any Autoset castors or fixed-direction wheel brackets. Compared with normal rubber tyres, it is stated, Duthane tyres of the same sizes have 3-4 times the load capacity, and 4-10 times the life. Working temperatures range from −20 to 120 deg. C., and the material is impervious to most oils and solvents.

7th European Machine Tool Exhibition, Brussels

Seventh Article

SOCIÉTÉ GENEVOISE TRIOPTIC UNIVERSAL MEASURING MACHINE

In Fig. 1 is shown the Trioptic universal measuring machine, which has recently been introduced by Société Genevoise d'Instruments de Physique, Geneva, Switzerland (Société Genevoise, Ltd., Newport Pagnell, Bucks.). This machine has a measuring range of 16 in. longitudinally, 8 in. transversely, and 8 in. vertically. If required, the microscope head can be raised by a maximum of 4 in. by means of packing blocks, and workpieces up to 14 in. high can then be checked. Components with weights up to 330 lb. can be supported on the 23·6- by 12·6-in. table.

The table, column and micrometer head are guided on high-precision, hand-scraped, vee and inverted-vee and flat ways, and when measuring is in progress, readings from totally-enclosed scales are projected on to screens which are mounted in convenient positions for viewing by the operator. The lengths of the guideways are such that there is no overhang when the moving members are at the ends of their travels, and the table and column are partly supported by rollers, to reduce friction. Made from steel and stabilized, the scales have a coefficient of thermal expansion similar to that of the cast iron bed, column, table and microscope head. In consequence, the need for correction is avoided when steel and cast iron parts are to be checked at room temperatures other than 68 deg. F. Movements are imparted to the table in the longitudinal direction, and to the column transversely, by variable-speed motors through gearing and rack and pinion drives, for coarse adjustment, and by knobs for fine setting. The microscope head is traversed on the column ways by a handwheel for coarse setting, and by a central knob for final positioning.

Adjacent to the projection screens for the longitudinal and cross traverses, there are moving-scale type indicators, which are driven from the table and column, and give readings to 0·050 in. A scale is mounted on the front of the column which gives readings for the position of the microscope head, also to 0·050 in. For accurately measuring the position of the table, column, or microscope head, the reticle on the associated projection screen is adjusted by means of a knob until one of 11 pairs of lines is positioned centrally with the magnified image of one of the lines on the measuring scale. There is a numeral for each pair of lines, and in this way the position of the member can be measured to an accuracy of 0·005 in. A circular scale on another indicator, close to the end of the projection screen, is rotated simultaneously with the movement of the reticle, and gives readings to 0·00005 in. The distance between the graduations on this scale is such that the position of the moving member can be estimated to an accuracy of 0·00001 in.

The measuring system has a guaranteed accuracy of 0·00004 + 0·0000025 × the distance, in inches, over which a measurement is made on the work. For example, a measurement can be made over a distance of 16 in. to an accuracy of 0·00008 in.

For obtaining datum settings at desired points in the travel of the table and column, the moving-scale indicators and the circular-scale instruments can be adjusted to give zero readings. When a datum setting is obtained for the microscope head,

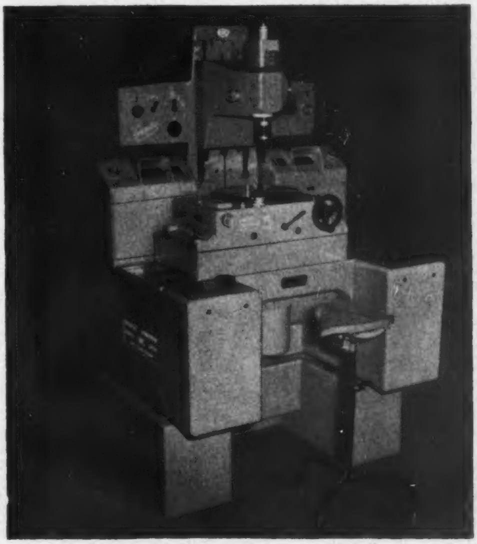


Fig. 1. Société Genevoise Trioptic universal measuring machine

a zero reading is obtained on the circular-scale instrument, and the scale on the column is adjusted to bring a whole-number graduation into line with the pointer. Datum settings for the three axes are then completed by adjusting the measuring scales independently until a magnified image of a graduation on each scale has been positioned between a pair of lines on the reticle on the projector screen. Knobs for adjusting the measuring scales are housed behind a cover to ensure that they are not accidentally turned. The feeler-type microscope normally provided serves as a sensitive fiducial indicator, and has a magnification of 70 ×. After the carbide-tipped feeler has been brought into contact with the work, when measuring is in progress, it is deflected until a magnified image of a central horizontal line and two pairs of vertical lines, marked on a small prism, have been positioned in relation to double cross lines on a reticle, which is observed through the eye-piece. For measurements in the vertical direction, the feeler can be moved in a precision ball track through a maximum distance of 0·1 in. above and below a central position, and is held in contact with the work under a force of 1¾ oz. The microscope can be set in four positions at 90 deg. to each other, with the aid of an indexing collar, when measurements are to be made on the work in the horizontal direction. A feeler attachment can be provided for checking internal screw threads for diameter and pitch.

A goniometric microscope can be supplied for checking angles and screw threads, also a precision electronic indicator, the measuring head of which is mounted on a motor-driven spindle. This instrument may be employed, for example, for setting workpieces accurately parallel with the bed-ways for the table, also for centring, and checking bores for roundness, diameter, centre distance and concentricity. Three magnifications are obtainable, which give full-scale readings of ±0·005, ±0·001, and ±0·0002 in.

The wide range of equipment available for the machine, also includes an 11·8-in. diameter rotary table, as shown, which has optical measuring equipment for accurate setting; an auxiliary table for mounting on the main work-table when small components are to be checked; a tilting work-table; and a table with a glass top plate and a built-in lamp unit for illuminating workpieces on which profiles are to be checked.

PHILIPS NUMERICAL POSITIONING EQUIPMENT

Numerical control equipment for co-ordinate setting, which has recently been introduced by N. V. Philips Gloelampenfabriek, Eindhoven, Holland (Research & Control Instruments, Ltd., 207 Kings Cross Road, London, W.C.1), is shown in Fig. 2 as applied to a jig borer. With this equipment, co-ordinate settings of the work-table can be obtained automatically under the control of punched tape which is fed through a reader built into the floor-mounted control unit. Alternatively, individual ordinates can be set up by means of five rows of push-buttons on the control unit, and movements of the table are then initiated by other push-buttons. When a setting has been completed, the positions of the table on the x and y axes are indicated by digital read-out units.

Table movements are imparted by separate motor drive units, which can be readily connected

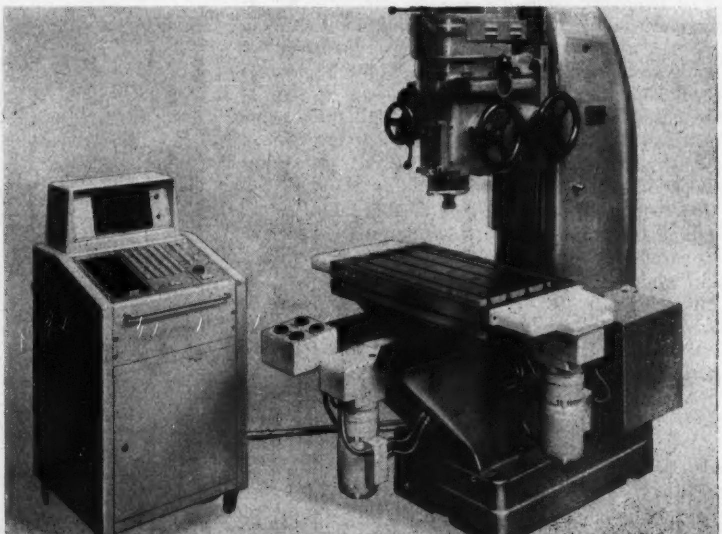


Fig. 2. The new Philips numerical control equipment for co-ordinate setting is here shown fitted to a jig borer

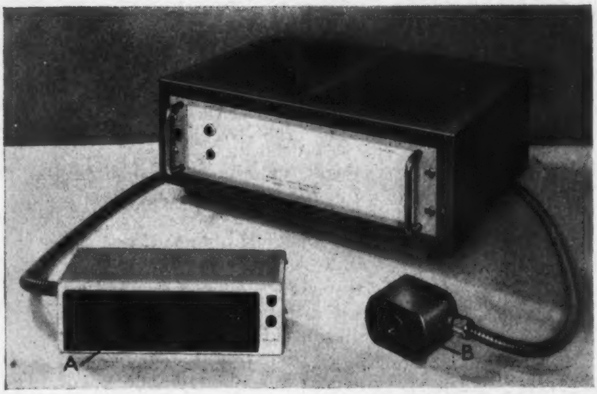


Fig. 3. With this new Philips equipment, the position of a work-table or tool slide on a machine is continuously indicated by numerals on the 5-digit display unit shown at *A*

to the screws for longitudinal and cross traverses when the handwheels normally fitted have been removed. Measuring equipment is incorporated in each drive unit, which serves to check the angular movement of the traversing screw, to an accuracy of 1/1000th part of a turn, and transmits feed-back signals to the control system when setting is in progress. Rapid power traverse is provided for coarse positioning, and during the cycle, the table speed is automatically reduced in two stages, so that a very slow movement is obtained for final setting. The table is always traversed in the same direction for final setting, to avoid errors due to backlash between the screws and nuts. If required, the table can be traversed by the drive units, independently of the positioning system, under the control of push-buttons mounted on the bed.

The new Philips numerical position indicator may be mounted on a horizontal boring machine, a milling machine or a lathe, for example. With this equipment, the position of the work-table or tool-slide on the machine is continuously indicated by numerals on a 5-digit display unit as shown in Fig. 3, which can be mounted in a convenient position for viewing by the operator, and the need for reading scales, when settings are being made, is thus avoided. During movement of the table or slide, signals from a digital transducer, as indicated at *B*, are transmitted to an electronic unit, which is connected electrically to the display equipment. Multiple transducers and display units can be provided for a horizontal boring machine, for example, for indicating the positions of the work-table in the longitudinal and transverse directions, and of the spindle head vertically. Each display unit can be set for zero by pressing a push-button to select a datum point at any position within the traverse movement of the work-table or spindle head.

On the display unit which is supplied for operation from the cross-slide traversing screw of a lathe, individual digits can be selected by separate knob-operated switches built into the instrument. With this arrangement, when the cutting tool has been brought into contact with the work, the instrument can be set to give a reading which corresponds with the work diameter. The cross-slide is then advanced until a reading is obtained which corresponds to the required work diameter, and the depth of cut is thus accurately set.

MAY TWIST DRILL ROLLING AND CUTTER GRINDING MACHINES

The May machine shown in Fig. 4 has been developed by Rohde & Dörrenberg, Dusseldorf-Oberkassel, Germany (Kimbell Machine Tools, Ltd., 4 Lambeth Place, London, S.W.8), for rolling spiral

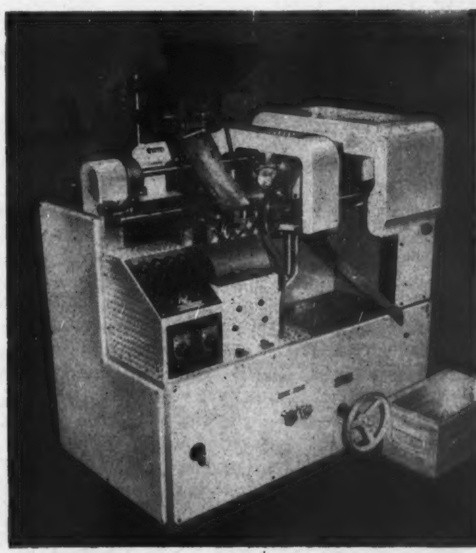


Fig. 4. May machine for rolling flutes and peripheral clearances in blanks for twist drills

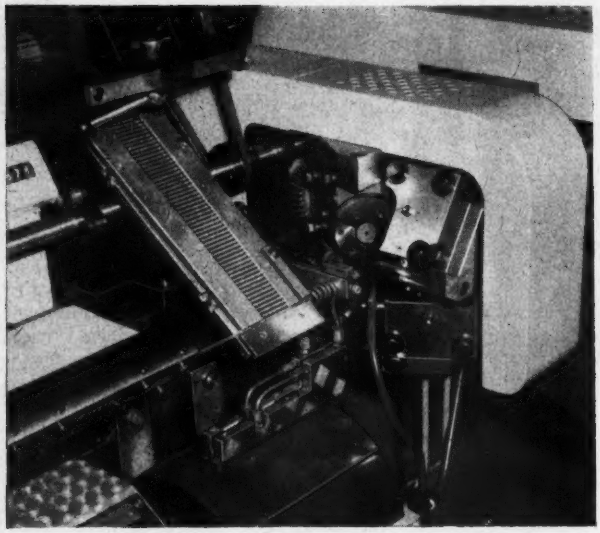


Fig. 5. Close-up view of the magazine chute, induction-heating coil and rolls on the May machine

flutes and peripheral clearances in blanks for twist drills. At each working cycle, the lowest blank in an inclined magazine chute, which may be seen more clearly in the close-up view Fig. 5, is advanced to the right by a pusher rod, to be passed into an induction heating coil. In this position, the blank is supported at its right-hand end by a guide bush.

Power supply for the coil is then switched on, and the portion of the blank in which flutes and peripheral clearances are to be formed is heated to the temperature required for rolling. After the power supply has been switched off at the end of the heating cycle, the blank is again advanced in the same direction by the pusher rod, so that the unheated right-hand end is passed between gaps in the rolls. Four rolls are provided, two of which serve to form the flutes and the others, the peripheral clearances. Drive to the roll shafts is now engaged, and rolling of the flutes and clearances is started at the shank end of the blank, and is completed in one revolution of the rolls. Finally, the completed piece is passed down a chute, to be discharged into a container at the front. After the rolling operation, it is stated, it is only necessary to grind the lands and the point.

The machine is available in three sizes for rolling twist drills up to ⅛ in. diameter, from ⅛ to 11/32, and from 11/32 to ⅜ in. diameter, which have overall lengths from 2·2 to 5½ in., and flute lengths from 1·18 to 3·34 in. Cycle times of only 2 to 3 sec. are obtainable on the smallest machine in the range, of 3 to 4½ sec. on the intermediate size, and of 5 to 8 sec. on the largest machine, depending upon the diameter of the twist drills to be rolled. It may be noted that the physical properties of the work material are improved by the rolling operation, so that greater toughness is obtained, and since the flutes and clearances are formed by displacing the metal, the length of the blank is considerably increased. In consequence, there is a considerable saving in the amount of steel required for the production of twist drills.

The new May type WH 50 relief grinding machine is shown in Fig. 6, fitted with a Diaform profile wheel dressing attachment made by Toolmasters, Ltd., Uxbridge Road, Hillingdon Heath, Middlesex. This machine enables relief grinding to be carried out on taps, reamers, stepped drills and countersinks, centre drills, and profile cutters for example, up to 2 in. diameter, and will accommodate lengths up to 19 11/16 in. The

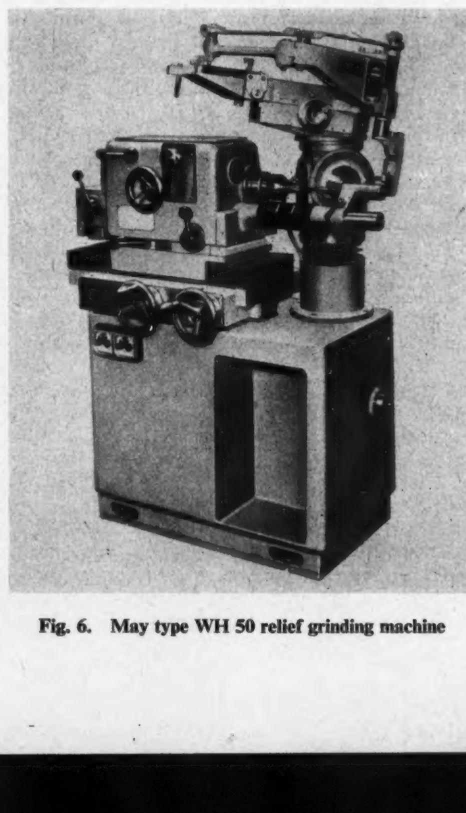


Fig. 6. May type WH 50 relief grinding machine

work-head has a maximum travel of 11 13/16 in. longitudinally and 6¼ in. transversely, and the handwheels are fitted with micrometer drums to facilitate accurate positioning of the work in relation to the grinding wheel. A vertical adjustment of 3 in. is provided for the grinding head, which will take wheels up to 8 11/16 in. diameter by 2 in. wide.

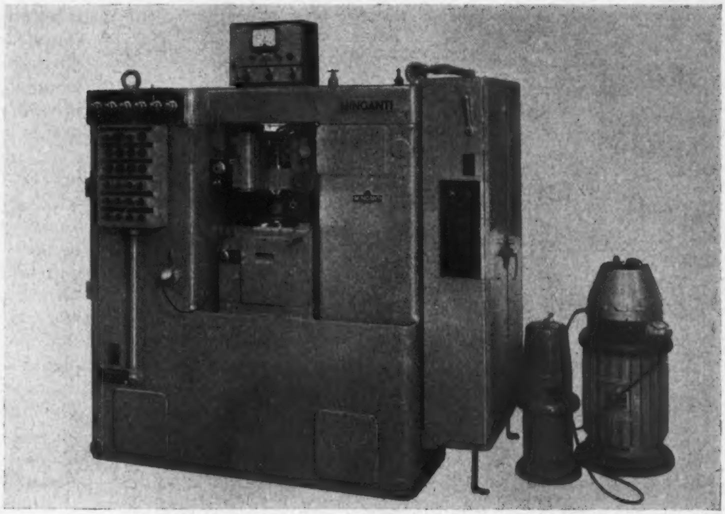


Fig. 7. Minganti Rim Zero machine for grinding bores in inner races for miniature ball bearings

Work-head movements of 0·023, 0·047, 0·078, and 0·13 in. can be obtained for grinding relief at the periphery of a cutter, and relief movements in a direction parallel with the work axis can be varied steplessly from 0·086 to 0·236 in. These motions can be applied simultaneously if required, for example, when relief is to be ground at the periphery and on a face of a stepped-diameter drill. Alternatively, the spindle can be rotated without any relief movement being applied to the work-head, to enable cylindrical grinding to be carried out. Spindle speeds of 18 and 6 r.p.m. are available for grinding cutters with two cutting edges, 12 and 4 r.p.m. for cutters with three edges, and 9 and 3 r.p.m. for cutters with four edges.

Workpieces can be held in a collet, or between centres mounted in the spindle and the tailstock, which is carried on a cylindrical guide bar attached to the work-head. Alternatively, sleeves can be accommodated in the spindle, which are bored to take Morse taper shanks in sizes from No. 2 to No. 4, and incorporate collets for gripping the cutter to be ground, close to the cutting edges.

MINGANTI RIM ZERO VERTICAL INTERNAL GRINDER

The Rim Zero vertical machine shown in Fig. 7 has been introduced by Guiseppe Minganti & C., S.P.A., Bologna, Italy (Industrial Sales, Ltd., 25 Barton Arcade, Manchester, 3) for grinding bores from 1 to 6 mm. (0·040 to 0·236 in.) diameter and of ⅜-in. maximum depth in inner races for miniature ball bearings. A close-up view of the working area is given in Fig. 8. The machine operates on a fully-automatic, continuous cycle, and incorporates air-operated arms for loading and unloading workpieces, also sizing equipment of the electronic type.

After a bearing race has been loaded, it is gripped by a self-centring chuck which is closed by centrifugal force when the work spindle is started. Next, the grinding head is lowered to pass the wheel into the workpiece bore, and reciprocating motion is then imparted to the work spindle hydraulically. During the grinding operation, a pair of feelers connected to the sizing equipment engages with the workpiece bore, and different cross feeds for rough and finish grinding, which can be pre-set in the range from 0·000004 to 0·0004 in. per stroke, are applied to the grinding spindle by means of cams.

Diamond-impregnated wheels are employed for grinding the smaller diameter bores in the range that can be handled on the machine, and abrasive wheels for the larger sizes. Dressing of abrasive wheels can be carried out automatically at the end of the rough-grinding stage of the cycle, if desired. The required diameter of the workpiece bore at the end of the rough- and finish-grinding stages of the cycle can be pre-set by controls on the sizing unit. When the entire grinding cycle has been completed, a signal is transmitted by the sizing equipment to stop the machine, and start the work loading and unloading sequence.

Speeds of 90,000, 120,000 and 150,000 r.p.m. are provided for the grinding spindle, and 2,500, 5,000

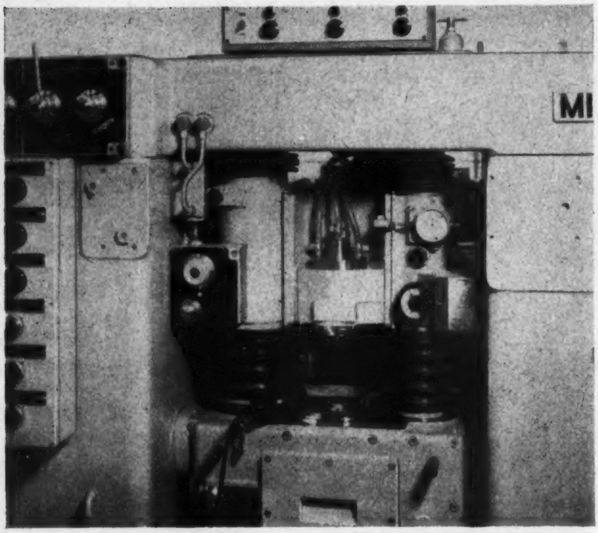


Fig. 8. Close-up view of the grinding and work spindles on the Minganti machine

and 10,000 r.p.m. for the work spindle, and the reciprocating motion can be varied from 2 to 570 strokes per min. Bearing races can be handled by the machine at the rate of about 180 per hour depending upon the amount of metal to be removed from the bore.

As an indication of the accuracy obtainable, it is stated that for grinding a bore of 0·040 in. diameter, the work can be held to a tolerance of 0·00008 in. for diameter, 0·00004 in. for taper, 0·00002 in. for roundness, and 0·0004 in. for concentricity. These accuracies are obtainable when the machine is operated in an enclosed space with an ambient temperature of 68 deg. F., and with coolant at 53·6 deg. F.

WORK HANDLING EQUIPMENT FOR + GF + COPYING LATHES

The new drum-type automatic work loading and unloading equipment for shaft components, which is shown in Fig. 9 mounted on a KDM-7/50 copying lathe built by Georg Fischer A.G., Schaffhausen, Switzerland (Vaughan Associates, Ltd., 4 Queen Street, Curzon Street, London, W.1), is noteworthy for its compactness and simplicity of design. With the set-up illustrated, two copying slides are mounted on the bed-ways and are brought into use simultaneously for profile turning the right-hand end and a central portion on 0·7-in. diameter by 10·34-in. long armature shafts which are made from steel with a tensile strength of 44 to 51 tons per sq. in. At the same time, two grooves with widths of 0·067 and 0·099 in. are turned at the right-hand end of the work by tools mounted on an in-feed slide. Machining operations are completed on each shaft in 4·5 sec., and the overall cycle time is only 8·7 sec. The headstock spindle is driven at a speed of 2,000 r.p.m., and continues to run while workpieces are being loaded and unloaded.

Mounted on the headstock, the work loading and unloading equipment can be swung outwards and moved to the left, to permit access to the tool slides for setting up. Referring to the line drawing Fig. 10, workpieces to be turned are loaded into the zig-zag type chute *A*, and the leading piece falls into the 4-station indexing carrier *B*. At each working cycle, the carrier is indexed to discharge

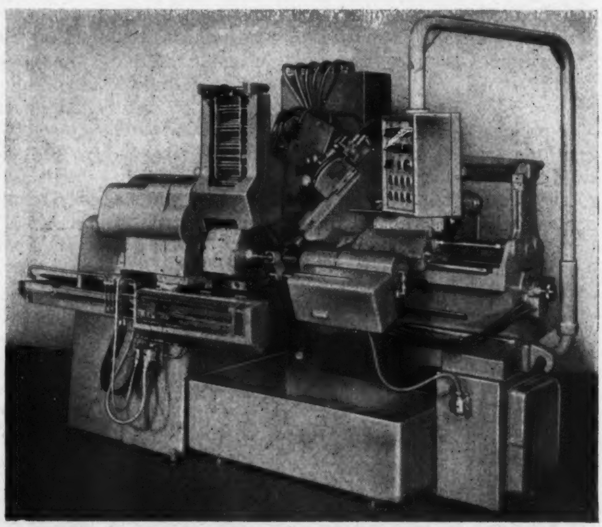


Fig. 9. +GF+ KDM-7/50 copying lathe fitted with a new drum-type work loading and unloading unit

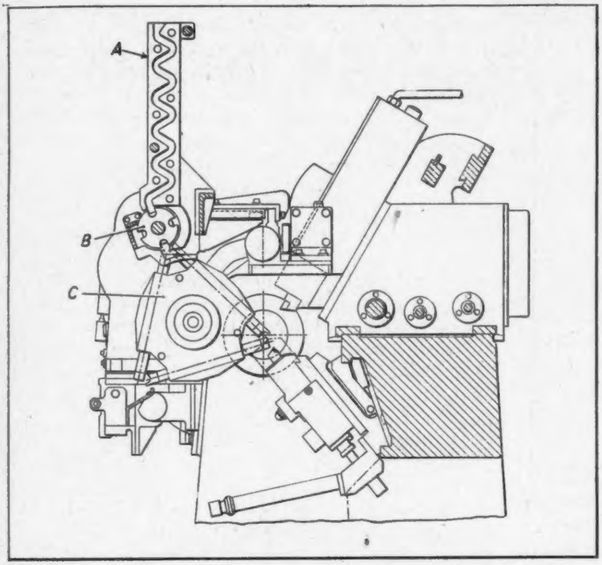


Fig. 10. A view, looking in the direction of the headstock, of the work loading and unloading unit mounted on the +GF+ KDM-7/50 copying lathe shown in Fig. 9

a fresh component on to support rails above the work loading and unloading drum *C*. This drum incorporates three sets of four plungers which are advanced outwards towards the periphery, and returned, by movement imparted to another plunger at the centre of the drum by a hydraulic cylinder carried on the tailstock. During the outward movement, the ends of the plungers in each set converge, and form, in effect, pairs of jaws for gripping the workpieces. The operating plunger has a ball end, and engages with a spherical seating in an arm attached to the piston rod of the hydraulic cylinder.

When the jaws of the work driver have been opened at the end of a machining cycle, the completed component is supported at its left-hand end by a spring-loaded centre housed in the bore of the headstock spindle. The tailstock centre is now moved to the right, and the workpiece is pushed in the same direction, clear of the work driver, by the action of the headstock centre. The plungers in the drum *C* are then moved outwards, with the result that one set grips the completed component, and another set holds the fresh blank carried on the support rails. Next, the drum is indexed through 120 deg. in a clockwise direction (as viewed in Fig. 10) to bring the completed component clear, and the blank into line with the headstock and tailstock centres. After the tailstock centre has been moved to the left, to pass the blank through the work driver, the plungers in the drum are returned to their original positions, to release the blank, also the completed workpiece, which falls into a horizontal trough at the front of the bed. When the jaws of the work driver have been closed to grip the blank, the machining cycle is started. Completed components in the trough are moved endwise by a cylinder, and are discharged, in

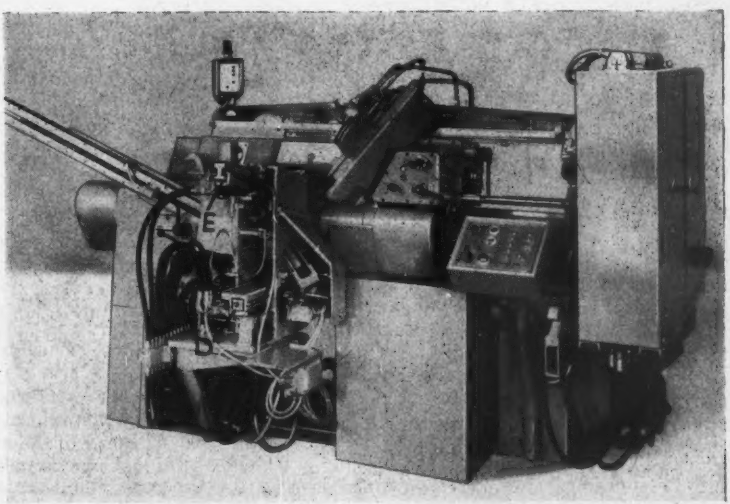


Fig. 11. This +GF+ KDM-7/50 copying lathe is fitted with automatic work loading, indexing, and gauging equipment for handling cruciform components for universal joints

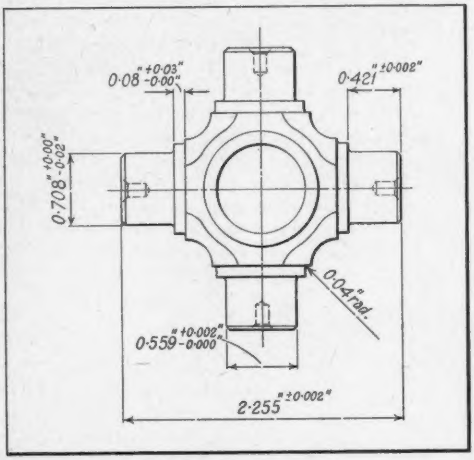


Fig. 12. The arms on this cruciform component for a universal joint are turned on the +GF+ copying lathe shown in Fig. 11, in a cycle time of 42 sec.

turn, into a container at the left-hand end of the machine.

Another type KDM-7/50 copying lathe is shown in Fig. 11 set up for turning cruciform components for universal joints, from steel forgings. The principal dimensions of the component are given in the line drawing Fig. 12. The arms on the workpiece are turned individually by a single-point tool mounted on the copying slide, and at the end of each stage of the operating cycle, the headstock spindle is stopped, and the component is indexed by an arrangement which will be described later, to bring another arm to the machining position. During the machining cycle, the component is held between centres, so that a high degree of accuracy for concentricity and alignment of the arms is obtained, and only from 0·002 to 0·007 in. is left for removal from each arm on the work, during subsequent grinding.

Forgings to be machined are loaded into an inclined chute at the left-hand end of the equipment mounted at the front of the bed, and at each cycle, the leading blank is passed by way of an escapement mechanism on to a forked carrier at the inner end of the slide seen at *D* in Fig. 11. This slide is now advanced hydraulically, and the carrier is then moved upwards to bring the blank into line with the headstock and tailstock centres. Next, the tailstock centre—and with it the workpiece and the sliding centre in the headstock spindle—is moved to the left. At the completion of this movement, the left-hand end of the blank is held in contact with the end face of the guide bush for the headstock centre. When the drive has been started, the blank is rotated by a peg in the end face of the headstock spindle, which engages with one of the arms on the work at right-angles to that which is to be turned.

After the copying slide has been returned to is starting position at the end of the turning operation on the first arm, the headstock and tailstock centres are moved to the right, to bring the workpiece clear of the driving peg, and the carrier is again moved upwards to support the piece. When the tailstock centre has been moved clear, the carrier is indexed through 180 deg., with the result that the workpiece is turned end-for-end in the horizontal plane. Next, the forging is once more moved to the left by the action of the tailstock centre, and the second arm is copy turned.

When the workpiece is once more supported by the carrier at the end of the turning operation on the second arm, the inclined hydraulically-operated slide *E* is advanced in a direction towards the work axis. As a result, a wheel at the inner end of this slide, which is fitted with a rubber tyre and can rotate freely, is brought into contact with the top surface of the workpiece. The carrier is now indexed through 90 deg., and the wheel ensures that the third and fourth arms are held horizontal, so that they are brought into line with the headstock and tailstock centres. After the third arm has been copy-turned, the component is again indexed through 180 deg., in readiness for turning the fourth arm.

When the spindle has been stopped at the end of the turning operation on the fourth arm, the completed component is again supported by the carrier, and after the tailstock centre has been brought clear, the slide *D* is moved in a direction away from the work axis. Finally, the component is discharged down a second inclined chute, and passes through a gauging unit at the lower end.

A spindle speed of 2,000 r.p.m. and a feed of 0·012 in. per rev. are employed for the turning operations, and the floor-to-floor time for completing one component is 42 sec.

DAVID BROWN/BINGHAM PUMPS.—David Brown Foundries, Penistone, have recently doubled the space allotted to the manufacture of double-volute centrifugal pumps, which are made under licence from The Bingham Pump Co., Oregon, U.S.A. Additional machine tools and plant are being installed, and the range of pumps being made is to be extended to include units for chemical plants in oil refineries.

Rockwell Machine Tool Demonstration

Some of the British- and Continental-built machines for which Rockwell Machine Tool Co., Ltd., are the selling agents, were demonstrated recently at their showrooms at Welsh Harp, Edgware Road, London, N.W.2. The principal exhibit was the German-built Fritz Werner type FV 2D vertical miller with punched tape control (see MACHINERY, 99/1043—1/11/61), which was set up as shown in the close-up view Fig. 1, for machining light alloy switch box components, held in duplicate fixtures, on a fully-automatic cycle.

These components house part of the electrical equipment provided on Fritz Werner machines for operating electro-magnetic clutches built into the feed gearboxes, for controlling movements of the work-table, cross-slide and knee, by hand. During the machining cycle, which is completed on both components in $7\frac{1}{2}$ min., a cut is taken on the top face of each part, also on bosses of different heights projecting from the bottom face, by a $1\frac{9}{16}$-in. diameter cutter which is run at a speed of 1,800 r.p.m. Various feeds from $1\frac{1}{4}$ to $39\frac{3}{8}$ in. per min. are brought into use automatically for milling different faces on the work, and during non-cutting portions of the cycle, rapid power traverse is applied to the table and cross-slide at the rate of 160 in. per min., and to the knee at 32 in. per min. As part of the demonstration, the same fixture and cutter were employed for machining other switch box components, which were generally similar in design to those illustrated, except that the bosses on the bottom face were of the same height, and there was no lug at one end. For changing the set-up, it was only necessary to replace the punched tape in the reader unit with another, and the cycle time for machining two switch box components of the second type was 5·8 min. Since separate clamps are provided, loading and unloading of workpieces can be carried in the fixture at one end, while machining of another component at the opposite end is in progress, and with this arrangement, the machine can be maintained in virtually continuous operation.

As was explained in the earlier article, feed-back signals, which correspond to the actual positions of the table, cross-slide and knee at various points in their travels, are transmitted by an analogue system from synchros, to which a backlash-free drive is provided by racks and pinions and gearing. As soon as the feed-back signal for movement in the longitudinal direction, for example, corresponds to that fed into a memory unit by the tape reader, a relay is operated to stop the table, and apply a brake, and at the same time a hydraulic clamp is brought into use. The tape is then advanced and the next movement is initiated.

In Fig. 2 is shown the Fritz Werner type FV 1D vertical milling machine fitted with the new "multi-channel" push-button control system for automatic operation. This equipment has been developed from the push-button control system previously available for Fritz Werner machines, but enables a greater number of functions to be engaged during the working cycle. In addition, the new system can be readily set up for controlling short traverse movements.

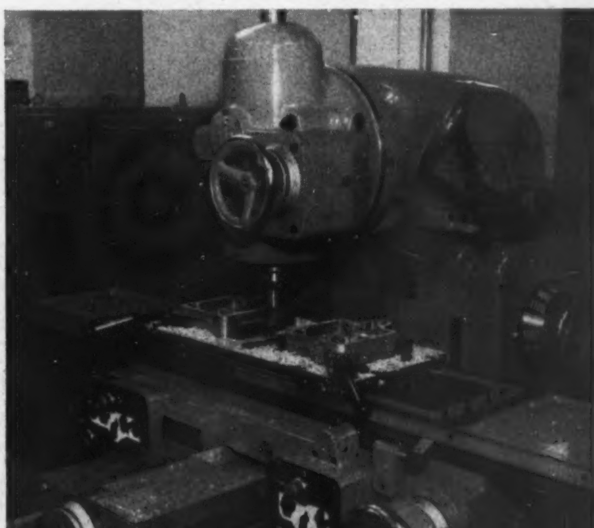


Fig. 1. Close-up view of the Fritz Werner type FV 2D tape-controlled vertical milling machine set up for operations on switch box components

Detachable carriers are provided on the machine, each of which has three T-slots to take adjustable L-shaped stops for controlling traverse movements in one direction. These stops can be set independently on the carrier so that the horizontal toes are positioned either above or below the fixing screws, and when the machine is in operation, they operate five staggered micro-switches. One of the micro-switches stops the moving member at the end of the working cycle, and others control feed and rapid traverse movements, as required, when milling is in progress. A stop in one row can be set with the toe above the fixing screw and slightly off-set in relation to a second stop in another row, the toe of which is arranged below the fixing screw. During the cycle, the individual stops operate separate micro-switches, and in this way feed movement can be controlled over a very short distance. The stop carrier and micro-switch unit for controlling movements of the table in the longitudinal direction may be seen in the close-up view Fig. 3, and similar assemblies are provided for the cross-slide and knee. Various points in the cycle at which the individual micro-switches are to be energized when they are operated by the stops, are selected by rows of push-buttons built into the control unit. If required, a sixth micro-switch and associated electrical equipment can be provided for each traverse movement, to give, in effect, five control "channels," and thus extend the scope of the system. Control equipment seen on the right in Fig. 2 incorporates two sets of push-buttons which enable a maximum of 40 functions to be brought into use during the operating cycle. If desired, however, the control system can be extended to permit a total of 80 functions to be selected for a particular milling cycle. (*Continued on p.* 1170)

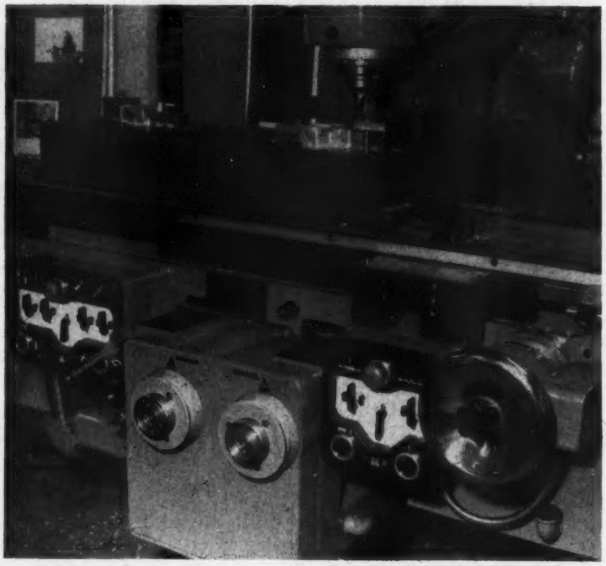


Fig. 3. Close-up view of the stop carrier and micro-switch unit for controlling table movements on the Fritz Werner machine

Fig. 2. The Fritz Werner type FV 1D vertical milling machine is here shown fitted with "multi-channel" push-button control equipment of new design

B.M.C. Expansion Programme

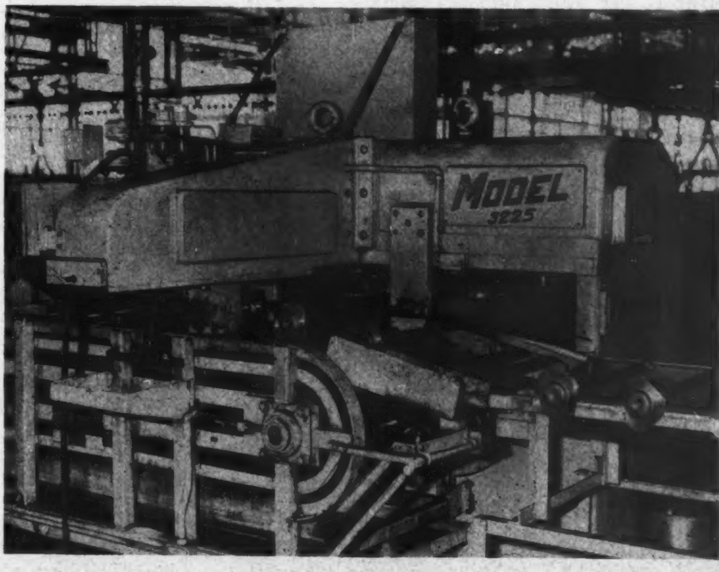
Some Details of the New "K" Block Extension at the Washwood Heath, Birmingham, Works of Morris Motors, Ltd.

AN EXTENSION TO A BUILDING KNOWN AS "K" BLOCK has recently been brought into operation at the works of Morris Motors, Ltd., Tractors and Transmissions Branch, Washwood Heath, Birmingham, and one of the first stages in the £49,000,000 expansion programme announced last year by the British Motor Corporation, Ltd., was thus completed. It is anticipated that the entire programme will have been brought to completion by the end of 1962, and that it will enable the production of vehicles in the B.M.C. range to be increased from 750,000 to 1,000,000 units per year. For example, it is expected that the output of Austin Seven and Morris Mini-Minor cars and vans will be raised from 200,000 to 400,000 vehicles per year.

Built at a cost of £777,867, the new extension provides additional manufacturing space amounting to 190,000 sq. ft., and plant which has been installed, also that housed in the original part of "K" block, is devoted to the production of axles and suspension units for all cars in the B.M.C. range. With the improved facilities, the production of axles and suspension units has been increased from 16,000 to 20,000 units per week. The entire building has a total floor area of 361,332 sq. ft., and houses some 360 machine tools, including a battery of 105 Gleason gear generators (Buck & Hickman, Ltd.) for the production of hypoid crown wheels and pinions, which is claimed to be the largest installation of its type outside the U.S.A.

In addition, there is a number of Ryder Verticalautos for machining brake drums, also a Michigan Roto-Flo machine [Ex-Cell-O Corporation (England), Ltd.], as shown in the illustration, for rolling serrations at the ends of rear axle shafts. A new Ransburg (Henry Peabody & Co. of London, Ltd.) automatic electrostatic spraying plant has been installed for painting completed assemblies. Throughout the building there is a comprehensive system of overhead conveyors for handling component parts, which largely obviates the need for storage areas on the shop floor. Some of these conveyors serve separate sections in the new extension, which are devoted to assembly operations on conventional axles and independent rear suspension units.

With the exception of transfer machines for performing operations on light alloy differential cages, plant which was formerly housed in another building known as "F" block, for performing certain operations in connection with the production of



Close-up view of a Michigan Roto-Flo machine installed in the new "K" block extension at the Washwood Heath works of Morris Motors, Ltd., for rolling serrations on rear axle shafts

axles and suspension units, has been moved to the new extension. As a result, floor space amounting to some 130,000 sq. ft. has been made available in "F" block, on which Nuffield Metal Products, Ltd. an associated company—have laid down three assembly lines for Austin Seven and Morris Mini-Minor bodies.

Contelyt Electrolytic "Grinding" Machines

Soag Machine Tools, Ltd., Juxon Street, London, S.E.11, have recently been appointed sole distributors in this country for Contelyt electrolytic "grinding" machines for sharpening carbide tipped cutting tools, made by Maschinenfabrik Uerkheim, Aargau, Switzerland. Examples from the Contelyt range are on view at a machine tool demonstration at the Battersea, London, showrooms of Soag Machine Tools, Ltd., which opens to-day and will continue until November 24.

With the electrolytic process, high rates of metal removal can be obtained, only a small amount of wheel wear takes place, and there is no heating of the work. For instance, it is stated that when an output of 80 to 100 amp. is provided by the generator built into the base, metal can be removed from a ⅜ by ⅜ in. surface on the work at the rate of 0·040 in. per min. Automatic voltage control is provided for the generator, and higher outputs can be obtained, to give correspondingly higher metal removal rates. It is claimed that a surface finish of about 10 micro-inches can be produced on the work, irrespective of the rate of metal removal. "Grinding" wheels employed on Contelyt machines are the subject of a patent application. An eccentric groove is provided in the end face of a cup-shaped wheel, and a wavy groove at the periphery of a disc-shaped wheel, which ensures that a film of electrolyte fluid is distributed evenly over the surface, and prevents sparking at the edges.

Swiss-built Contelyt electrolytic "grinding" machine for sharpening carbide-tipped cutting tools

Three machines are at present available, namely, the Contelyt Cadet, for handling cutting tools with shank thicknesses up to 1½ in.; the type PH 175, shown in the illustration, which has an oscillating wheel spindle and is intended for grinding carbide tips in batches, also tipped cutting tools up to 2½ in. thick; and the type PV 23. The last mentioned machine is fitted with duplex rotary worktables, and is also intended for grinding carbide tips in batches. Other types of electrolytic grinding machines are being developed, including designs to suit particular requirements. In addition, electrolytic grinding equipment comprising a generator with a rating of 72, 200, 300 or 500 amp., a special ISO insulated spindle unit, and a Contelyt wheel, can be provided for use on conventional grinding machines of universal, internal, surface and profile types.

20,000th Pfauter Gear Hobber

The German firm of Hermann Pfauter recently completed their 20,000th gear hobbing machine, and to mark the occasion a celebration was held in the works at Ludwigsburg, which was attended by a large number of business associates and distinguished guests, including representatives of the local and federal Governments.

In his welcoming address, Dr. Michael Pfauter recalled that the company had celebrated the building of their 10,000th gear hobber in 1936. Since Hermann Pfauter established the works at Chemnitz in 1900, it had taken 36 years to build that number of machines. The second 10,000 machines had been built in 25 years, in spite of the collapse of German industry in 1945. Fig. 1 shows the 20,000th Pfauter machine with the first machine built by the company.

Hobbing machines were built at the Chemnitz factory throughout the war, and by 1945, 17,000 machines had been completed. As a result of the division of Germany, it was decided to leave Chemnitz, and the Pfauter family and a considerable number of technical workers moved to Berlin.

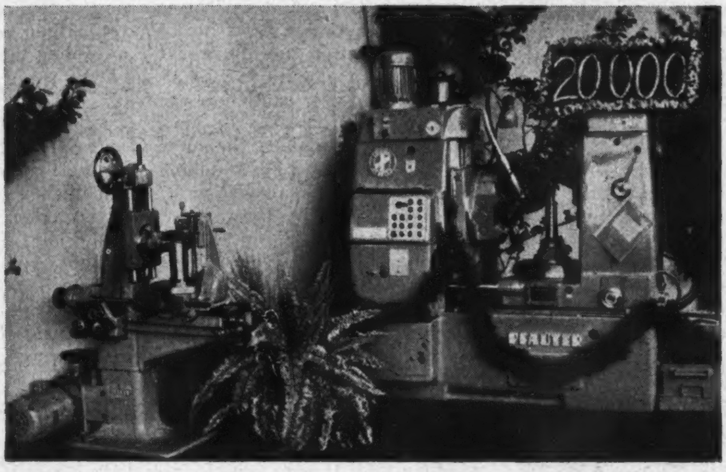


Fig. 1. The 20,000th Pfauter hobbing machine on display with the first machine built by the company during the celebrations at the Ludwigsburg plant

Due to restrictions imposed on the company at that time, only a small machine, known as the type R 16, was designed, but the company's design and other staff were kept together during the uncertain period from 1946 until the currency reforms of 1948, in case the control authorities should grant permission for the firm to build medium-sized machines. During this period, a temporary home for the staff and their families was established in Minden, where accommodation was found for a technical office.

The possibility of starting machine building operations in the Bundesrepublik was explored, but nothing was done immediately because, with the cessation of aero-engine production, a large market for Pfauter machines had been lost, also it was feared that any plant would be dismantled by the control authorities. In 1948, however, the company's former business associates, Gebruder Eickhoff, at Bochum, built fifteen Pfauter RS2 machines, retaining five for their own use and making ten available to the company for sale.

In June, 1947, the Opel company placed at the disposal of Pfauter a small building at Rüsselheim that had been damaged by bombing. A limited amount of equipment was installed, and these small works offered the first organized production facilities that were available to the Pfauter company after leaving Chemnitz. In the autumn of 1949, the company moved to another factory at Kornwestheim, where the labour force numbered 40. This factory had been a Panzer-repair depot, and the type RS1 hobbing machine was built, followed by the small R16. When the Americans took over the depot for the use of their armed forces, however, a further move had to be made.

The Ministry of Economics could not offer any readily-available premises that were suitable for a factory, and it was decided to plan a new works. A site of the necessary size was found at Ludwigsburg, and the Ministry of Economics and the banks made available a sum of DM 200,000. The

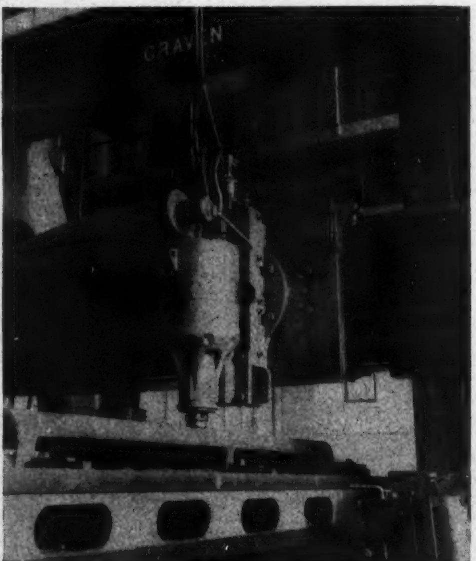
Fig. 2. Part of the assembly bay of the Pfauter factory at Ludwigsburg

new works were ready for machine building operations in 1951, and a view of part of the assembly bay is given in Fig. 2. Machines with capacities from 9⅜ to 35⅜ in. diameter have been made at the Ludwigsburg works, and of the last 3,000 Pfauter machines built, about 55 per cent have been produced at the new factory or the works at Kornwestheim. The remainder were built by Eikhoff and Siemens & Halske (1 per cent, 1949-1951), Frieseke & Hoepfner (21 per cent, 1950-1961), and Schwartzkopff (23 per cent, 1951-1961).

Hermann Pfauter are represented in this country by Vaughan Associates, Ltd., 4 Queen Street, Curzon Street, London, W.1.

Futurmill Demonstration

Demonstrations were given recently by Futurmill Conversion, Ltd., 6 The Headway, Leeds, of a Futurmill conversion unit applied to the cross-rail of a large Craven planing machine at the Willow Lane works of Morfax, Ltd., Mitcham, Surrey. The demonstrations were staged by the courtesy of the latter company, and a close-up view of the milling unit in operation is shown in the accompanying figure. The unit here shown is of the latest design, and incorporates a built-in blower, as seen at the top, to assist in cooling the 2-speed motor when it is used at the lower speed, and to provide for continuous running.



A Futurmill conversion unit mounted on a large double-column Craven planing machine at the Willow Lane works of Morfax, Ltd. The unit was recently demonstrated on steel and cast iron workpieces

Rated at 50/25 h.p., the motor can be run at 760 or 365 r.p.m. and the rotor is integral with the cutter spindle. For roughing cuts, the higher spindle speed is employed with a 3-in. diameter Futurmill indexable throw-away-tip type cutter, and for finishing, a 7-in. diameter cutter of the same type it is run at a speed of 365 r.p.m. Typical operating conditions during the demonstration were as follows: cast iron workpiece, 3-in. cutter, 365 r.p.m., depth of cut ⅜ to 7/16 in., feed rate 80 in. per min.; steel workpiece 3-in. cutter, 760 r.p.m., depth of cut ½ in., feed rate 60/70 in. per min.

On one cast-iron platen, which measured 9 ft. by 5 ft., feed rates as high as 90 in. per min. for roughing and 120 in. per min. for finishing were employed, with a 3-in. diameter cutter running at 365 r.p.m.

Exhibition of Prat-Daniels Equipment

Many examples of dust collecting equipment for industrial use were displayed recently at an exhibition held in Birmingham by Prat-Daniels (Stroud), Ltd., Whitecroft, Nailsworth, Gloucestershire. A prominent exhibit, which attracted much attention, was a section of a multi-tubular dust collecting installation designed to intercept and precipitate airborne particles at a cement works, similar equipment being suitable for collecting fly ash from boiler flues and dust from knock-out areas in foundries, for example. The use of a number of small cyclone precipitators grouped in a common casing, as in this equipment, is stated to ensure an unusually high efficiency of dust collection. The Prat-Daniels small tubular precipitators are produced in standard block units which can be assembled, as required, into groups of any size.

A low resistance dust collector, which was also on view, has been introduced as a means of reducing the emission of grit from the stacks of small industrial boiler installations. Gases entering the stack from the boiler are diverted by deflectors into the body of the collector where a pressure drop occurs.

As a result, the entrained dust particles lose velocity and fall on to a sloping plate while the cleaned and expanding flue gases return to the stack and pass to the atmosphere. Accumulations of dust slide to an outlet at the base of the collector and thence by pipeline to a storage hopper. Fig. 1

shows a group of five Prat-Daniels low resistance dust collectors of the type described, installed at a factory in Bedfordshire.

Examples of wet dust collecting equipment displayed included a model of a dust and spark arrester for fitting to the top of a foundry cupola, and a Wetclone mobile dust collector intended for workshop use.

The dust and spark arrester incorporates a deflector which removes large particles from the waste gases leaving the cupola, and a water spray which quenches sparks, cools the deflector cone, and intercepts most of the remaining dust particles. The sludge formed during the cleaning and quenching processes gravitates to a settling tank.

The Wetclone, seen on the right in Fig. 2, takes the form of a wheel-mounted cylinder partly filled with water which is lifted in the form of droplets into a vortex created by cyclonic action. Dust laden air drawn into the cylinder through flexible ducting is entrained in the stream of water droplets and circulated at high speed through the cyclone and thence to the water bath. The wetted dust remains suspended or precipitated in the water and the cleaned air passes upwards and escapes to atmosphere through a metal filter. Wetclone dust collectors may be fitted to machines employed for polishing and grinding operations, also to enclosures where metal spraying is carried out.

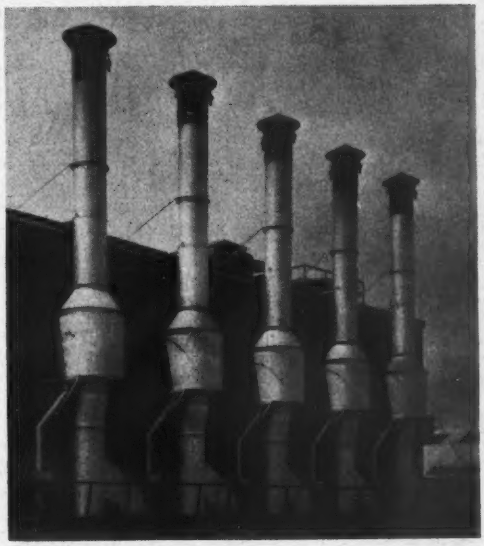


Fig. 1. A group of five Prat-Daniels low resistance dust collecting units installed at a factory in Bedfordshire

The main features of a Prat-Daniels Turbocollector combined induced-draught fan and grit arrester were shown by means of a scale model. Particles of solid matter, such as fly ash and grit from a shell-type boiler installation, are thrown outwards by centrifugal force to the periphery of the fan casing, with the result that the gas stream in the inner part of the fan scroll is left relatively free from dust.

Fig. 2. Examples of Prat-Daniels equipment shown at a recent exhibition in Birmingham, with a Wetclone dust collecting unit on the right

The heavily contaminated gas layer is diverted into a cyclone separator, while the remainder passes to the fan discharge. On emerging from the cyclone separator, the cleaned gas is returned to the fan inlet through ducting, and the precipitated dust falls into a hopper or removal chute.

Attention was drawn to the services which Prat-Daniels provide in connection with the suppression of atmospheric pollution, ventilation of industrial premises, gas washing, and pneumatic conveying. The company is developing equipment which will mitigate the unpleasant effects of fumes produced by various industrial processes, and it is stated that fume incineration is a promising field of research.

NEWS OF THE INDUSTRY

London and the South

DOWDING & DOLL, LTD., 346 Kensington High Street, W.14, report a keen interest in their British-built Wiedemann turret punch presses which may be employed both for short-run and production piercing. The type R.61 machine is designed for heavy-duty applications. It has a punching force of 80,000 lb., and may be fitted with circular punches up to 6 in. diameter, or shaped punches of equivalent perimeter, for piercing mild steel sheet ⅜ in. thick. The turret, which may have 20, 24, or 28 stations, is rotated by a geared ½-h.p. motor and the main drive is taken from a 3-h.p. motor. Direct reading scales are provided to facilitate work setting. The larger R.7 turret punch press may be provided with as many as 32 tool stations, and is suitable for punching holes up to 6½ in. diameter in ¼-in. thick steel plate. With a throat depth of 60 in. and a punching force of 160,000 lb., this machine is suitable for performing a wide variety of piercing and notching operations on plates up to 120 in. long.

The Dowding Atlantic co-ordinate table with Ferranti electronic equipment, with a claimed positioning accuracy within 0·0005 in., is in production. Tape control can be employed for longer runs and decade dial settings for single workpieces and short runs. Kensington injection moulding machines of ¾-oz. capacity are in increasing demand. Two versions are available, one fully automatic and the other arranged for manual closing of the mould halves with subsequent hydraulic operation of the injection system.

TATE MACHINE TOOL CO., LTD., 348-354 Kensington High Street, W.14, advise us that an increasing volume of orders is being received for Muller power presses. These presses, which are provided with simple means of stroke adjustment and height positioning of the tables, are built in a number of sizes with ratings of 8 to 100 tons. Recently, the company has delivered a number of the larger used machine tools from their warehouse, including planing machines and grinders, and to provide for an improved delivery service, a low-loading vehicle of 12-ton carrying capacity has been acquired. During recent months, it is reported, there has been a gradual increase in the demand for new and used machine tools.

HICKS MACHINERY, LTD., Addison Place, W.11, are receiving numerous enquiries for Magdeburg type D 30 production lathes and type DH 300 copy-turning lathes, the latter being fully automatic in operation when fitted with loading equipment. Both machines can be supplied with spindle speeds up to 1,500, 2,000, or 3,000 r.p.m., as required. These machines are installed in shops which are engaged in the production of precision turned parts for the optical instrument and aircraft industries, for example.

VICTA ENGINEERING COMPANY, Blandford Road, Hamworthy Junction, Poole, Dorset (head office, Tollgate, Thicket Corner, Maidenhead, Berks.), are increasing the output of their Eagle surface grinding machines for wet and dry working, with table capacities ranging from 12-in. by 6-in. to 24-in. by 8-in., also of the Hobson 5½-in. centre lathes with all-geared headstocks and provision for screwcutting. The shops are of recent construction and extend to an area of 15,000 sq. ft. on a site which will permit of further development.

COVENTRY GAUGE & TOOL CO., LTD., have a modern works at Alder Road, Poole, Dorset, which provides production facilities to supplement those afforded by the principal factory at Coventry. The design and machine tool building departments are at present busy with orders for internal and external thread grinders, also broaching machines and a number of special purpose grinders. A development section has been established here and the activities include building and extensive testing, under varying conditions, of prototype precision machine tools. There is also an electronic control group which is investigating various methods of applying such control systems to machine tools. On the production side, we may note that a set-up was provided recently for thread-grinding a number of 2 B.A. dies. A high-frequency type grinding spindle was employed to obtain the requisite wheel speed.

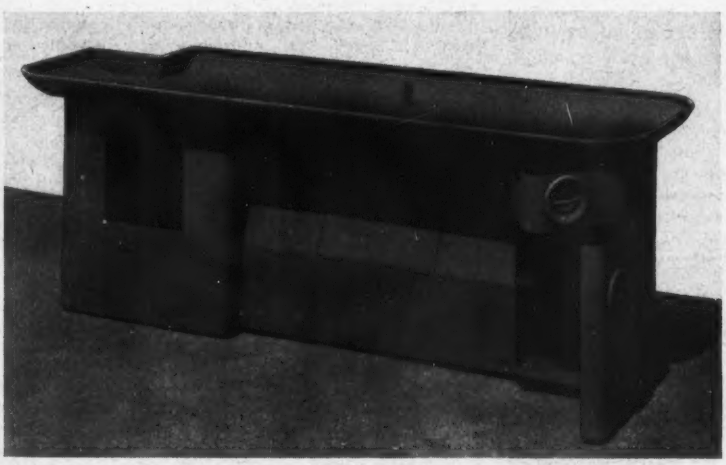
THE LOEWY ENGINEERING CO., LTD., Wallisdown Road, Bournemouth, Hants., are still very busy with

orders for rolling mills, for hot and cold working, and large hydraulic presses for various applications including the extrusion of non-ferrous metals. An extensive building programme is in progress here, mainly to provide additional space for the design departments and administrative sections.

MEGGITT MACHINE TOOLS & EQUIPMENT, LTD., Wallisdown, Bournemouth, who are concerned with the distribution of machine tools of various types, also welding equipment, small tools, and engineers' supplies, will later occupy new and commodious premises which are to be built on a site close to their existing offices and works. With an area of 11,500 sq. ft., the new buildings will have a frontage to the main road from Ringwood and will provide a large showroom, a warehouse, and a working area with ample overhead crane facilities.

MEGGITT ENGINEERING, LTD., Wallisdown, Bournemouth, are steadily expanding the production of high quality lathe cabinets, an example of which is shown in the illustration, and machine tool accessories including spindle nose keys and coolant feed assemblies. The output of lighting fittings for use with liquified petroleum gases is maintained at a steady level and there is a good demand for machined parts which are produced in batches under sub-contract. Part of the 24,000 sq. ft. of floor space is reserved for the manufacture of weld-fabricated structures of various types, and we are informed that assemblies weighing up to 5 tons can be produced.

F. W. HERRIDGE.



This fabricated lathe cabinet, which is 12 ft. long, is typical of the work undertaken by Meggitt Engineering, Ltd., Bournemouth

British Productivity Council Films

Four new films on productivity were recently shown in London by the British Productivity Council, Vintry House, Queen Street Place, London, E.C.4.

"Fitting the Job to the Worker," is the title of one of these films, which shows how ergonomics can be of practical value to both management and employees. The principles of ergonomics are discussed, and it is explained how these principles have been applied to the design and installation of a steelworks overhead-crane cab and driver's seat, for example.

In a second film, entitled "A Case for Shiftwork," the various arrangements of shift working are examined and the human problems involved are considered. Attention is drawn to the need for full and early consultation between management and trade unions, and it is emphasized that shiftwork will only be successful when the particular system that is adopted is suited to both the machines and those who operate them.

A third film is concerned with "Change and Employment," and deals with the technological changes which have taken place in industry and their effects on the lives of those employed. Examples of good management practice are given in situations where new methods have resulted in changes in the numbers of people required.

The remaining film—"The Man in the Middle"—tells the story of a foreman's difficulties in his relations with the work-study officer, the maintenance engineer, the quality-control inspector, and various specialist departments. It goes on to describe a well-intentioned attempt by management to solve the problems which arise, by sending the foreman on supervisory training courses. His relationship with the specialist departments improves through a better understanding of their techniques and difficulties, but the advantages of the training are largely lost because the attitude of management remains basically unchanged. The film shows that the training of foremen cannot be treated in isola-

tion and that management must provide a logical organization in which the limits of responsibility are clearly defined.

Copies of these films may be purchased from the Council, or they may be hired from the Central Film Library, Government Building, Bromyard Avenue, London, W.3.

The Company Research Department

(*Continued from page* 1115)

ing it with a patent application which enables competitors and even customers to apply all their efforts to circumvent the patent instead of working on their own original ideas."

The maintenance of a research department on a scale adequate to enable a company to keep pace with competition, both at home and abroad, at a time of such rapid technical advance, may involve considerable annual expenditure. It is therefore increasingly important, both in the interests of the company and the nation, that due attention should be paid to such aspects as were discussed by Sir Kenneth, for the purpose of ensuring that the efforts of the scientists and technologists concerned are turned to the best account, and not wastefully dissipated.

Rockwell Machine Tool Demonstration

(*Continued from page* 1162)

When milling is in progress, the cutting feed can be automatically reduced in the ratio of 5 to 1, at a number of pre-set points in the cycle, if required, to enable the cross-slide, for example, to be accurately positioned at the end of the cut, before longitudinal feed is applied to the table for milling the side of a slot. A point in the cycle at which reduced feed is to be applied is selected by a push-button in one of the rows on the control panel, and depression of a corresponding push-button in the next row prevents the brake built into the gearbox from being applied, so that a smooth change-over from coarse to fine feed is obtained.

"Multi-channel" push-button control equipment can be supplied for other milling machines in the Fritz Werner range.

G.T.M.A. Competition Prize-winners

The results of the 9th competition for craftsmanship and draughtsmanship organized by The Gauge and Tool Makers' Association, Standbrook House, Old Bond Street, London, W.1 (see MACHINERY 99/1052—1/11/61), have recently been announced, and the awards were made as follows:

CRAFTSMANSHIP SECTION.—Group 1, drill jig, R. K. Lewis [Moore & Wright (Sheffield), Ltd.]; milling fixture, C. P. Knight (Coventry Gauge & Tool Co., Ltd.); Group 2, gauges, K. S. McGonigle (Peter Brasshouse, Ltd.); Group 3, face cutter (3rd prize only awarded), D. Clarke (Hall & Pickles, Ltd.); end mill, H. Such (Aldridge Tool & Engineering Co., Ltd.) and B. Hancock (Hall & Pickles, Ltd.) tied for first prize; Group 4, press tool, A. M. Spargo (Slater Tool Co., Ltd.); Group 5, moulds and dies, no entries; Group 6, drill jig, B. Savage (Thomas Keating, Ltd.); fixture, J. N. Springett (Kemworthy Jig & Press Tool Co., Ltd.); Group 7, gauges, C. Pritchard (J. E. Shay, Ltd.); Group 8, shell end mill, L. Bradbury (Hall & Pickles, Ltd.); special side and face cutter, K. Gwilliam (Brooke Tool Manufacturing Co., Ltd.); Group 9, press tools, L. J. Barrett (Thomas Keating, Ltd.); special prize, T. D. Pope (Hayes Precision Tools, Ltd.); Group 10, moulds and dies, no entries; Group 11 (major open group), R. G. Hyde (Enfield Tool Manufacturing Co., Ltd.).

DRAUGHTSMANSHIP SECTION.—Group 12, jigs and fixtures, A. G. Walker (Kemworthy Jig & Press Tool Co., Ltd.); Group 13, gauges, 2nd prize only, G. Russell (Coventry Gauge & Tool Co., Ltd.); Group 14, cutting tools, H. Hill (Hall & Pickles, Ltd.); Group 15, press tools, F. A. Wild (G.P.A. Tools & Gauges, Ltd.); Group 16, moulds and dies, I. A. Evitts and M. M. Linley (Fox & Offord, Ltd.) tied for first prize; Group 17 (open group), T. Gatiss [Vickers-Armstrongs (Engineers), Ltd.].

"Times" Machine Tool Demonstration

The Times Machinery Co., Ltd., Poyle Road, Colnbrook, Slough, Bucks., in collaboration with their associates Frye Machine Tool Co., Ltd., and Sheet Metal Machinery Co., Ltd., will hold a demonstration week in their showrooms (close to London Airport) from November 27 to December 2 inclusive. Many of the 150 machines to be displayed will be under power, and it is stated that they will include nearly 40 which have not previously been shown in this country. The exhibition will be open daily from 10 a.m. to 7 p.m., and all engineers interested are invited to attend.

New Aerograph-DeVilbiss Factory

To meet the growing demand from home and overseas markets for spray painting and finishing equipment, new and larger factory and administration premises have been built at West Howe, Bournemouth, for the Aerograph-DeVilbiss Co., Ltd. The overall size of the building is 520 ft. long by 170 ft. wide, and the production of spray guns, air compressors, automatic spray coating machines, portable spray painting plants, airless spraying equipment and water-wash and dry-back spray booths has been transferred from the premises at Lower Sydenham. In addition, the company's head office, sales division, and export department have been moved to West Howe, and an enlarged spray painting instruction school and demonstration and customer research centre have been provided.

The existing sales division office at 47 Holborn Viaduct, London, E.C.1, will continue to handle business in London and the Home Counties, also the maintenance and spare parts service in those areas.

Personal

SIR LEONARD LORD, K.B.E., has resigned from the office of executive chairman of The British Motor Corporation Ltd., Longbridge, Birmingham, on reaching the age of 65. He has, however, agreed to remain on the board as a non-executive director, and to become vice-president of the Corporation.

MR. LAURENCE EASTAUGH, a charge-hand at the Leyland works of BTR Industries, Ltd., has received his third cash award under the company's suggestions scheme which has now been in operation for three years. It is estimated that this latest suggestion will result in a saving of £3,000 per annum in connection with the manufacture of typewriter accessories, and Mr. Eastaugh will receive a total of about £300 in four quarterly payments.

The following new appointments have been announced:—

MR. D. H. HORTON, as works manager of E.M.B. Co., Ltd., Moor Street, West Bromwich, Staffs.

MR. B. SMITH as a director of Osborn-Mushet Tools, Ltd., Clyde Steel Works, Sheffield, 3.

MR. G. W. HARRIMAN, hitherto deputy chairman and managing director, as chairman of the board of The British Motor Corporation, Ltd., Longbridge, Birmingham, following the retirement of Sir Leonard Lord from this post.

MR. A. F. ROGER, chairman of Automatic Telephone & Electric Co., Ltd., and Sir Harold A. Wernher, Bt., G.C.V.O., T.D., chairman of Ericsson Telephones, Ltd., as directors of The Plessey Co., Ltd., Ilford, Essex. These appointments follow the completion of the merger between the three companies.

MR. C. R. TEARNE, formerly technical sales manager, as a director, MR. W. GUSS as technical sales manager, MR. T. LEWINS as chief machine tool designer, and MR. P. WEDGWOOD as chief engineer of Churchill Gear Machines, Ltd., Blaydon-on-Tyne, Co. Durham. Mr. Tearne has been closely associated with the development of the "Link Line" system for the automated production of gears.

Obituary

MR. W. H. HUMPHRYES, 8 The New Road, Colindale, London, N.W.9, who was still working as representative for Norman E. Potts (Machinery), Ltd., of Birmingham, for the London area, died at the age of 93, on November 11.

Changes in B.S.I. Structure

Changes have been made within the technical directorate of the British Standards Institution, 2 Park Street, London, W.1, to permit greater efficiency in meeting a rising demand for standards from a continuously widening circle of interests, and to deal with the rapidly increasing volume of international standards work. Hitherto the technical work of the Institution has been handled internally within five sections, but the number has now been increased to seven, by the addition of sections concerned with: metallurgical and some engineering industries; and safety and of consumer standards. It may also be noted that "codes practice" work has been combined with building activities.

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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15/11/61

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Industrial Notes

JAMES ARCHDALE & CO., LTD., ask us to point out that their sole address is now Blackpole Works, Worcester, and that their Birmingham works were closed some months ago.

BOWTHORPE HOLDINGS, LTD., Crawley, Sussex.—The telephone number of this company and the subsidiaries—HELLERMANN, LTD., and BOWTHORPE ELECTRIC CO., LTD.—is now Crawley 28888.

THE GEAR GRINDING CO., LTD., Shirley, Birmingham, have appointed Ernst Polack Sondermaschinen, Stuttgart, N, as sole agents in Western Germany for the full Orcutt range of machine tools.

SQUARE D, LTD., Cheney Manor, Swindon, Wilts., report that the construction of their new factory has begun on an adjacent site. This factory will have an area of approximately 125,000 sq. ft. and is scheduled for completion by the middle of 1962.

HAGAN CONTROLS, LTD., a member company of the Plessey Group, have moved to Weedon Road, Northampton (telephone, Northampton 260). Here they are adjacent to the Plessey Group development and manufacturing units.

AN AUCTION SALE OF VEHICLES, MACHINE TOOLS and miscellaneous stores will be held at the W.D. Storage Depot, Bowhouse, Hurlford, nr. Kilmarnock, Ayrshire, on November 30 and December 1. The auctioneers will be Dixon & Wallace, Ltd. (Dept. L), Bank Buildings, Graham Square, Glasgow, E.1.

ENGINEERING INDUSTRIES ASSOCIATION, North West Region, 178 Corn Exchange Buildings, Fennel Street, Manchester, 4, will hold a one-day display in the Edinburgh Suite, Belle Vue, Manchester, on November 21. Some 55 firms will participate, and the display will be opened at 11.30 a.m.

ELGAR MACHINE TOOL CO., LTD., 172-178 Victoria Road, Acton, London, W.3, have been appointed exclusive distributors in the United Kingdom for the internal key-seating machines, built by Maillefer S.A., Lausanne, Switzerland. The machines are made in three sizes with varying ranges of stroke up to 47 in., and are suitable for keyways up to 5⅞ in. wide.

E.C.G.D. BUSINESS.—The Export Credits Guarantee Department, 59-67 Gresham Street, London, E.C.2, report that business declared under E.C.G.D. "commercial" insurance during July to September last amounted to £190·5 million. This total, which was a record for the quarter, exceeded by £10·3 million the figure for the corresponding period of 1960.

CONSOLIDATED ELECTRODYNAMICS CORPORATION (U.K.), LTD., was formed recently with headquarters at 14 Commercial Road, Woking, Surrey (telephone, Woking 5633). Initially, electronic instruments made by C.E.C. Inc., Pasadena, Calif., U.S.A., will be marketed. In addition, arrangements are being made to produce ranges of C.E.C. transducers and oscillographs to meet British and European requirements, and it is anticipated that the works will be in operation by the middle of 1962.

STEEL PRICES.—The Iron and Steel Board has authorized increases in the prices of steel products containing molybdenum, following a rise in the cost of ferro-molybdenum. In addition, the price structure for hot-rolled carbon steel strip has been revised. As a result, prices, in general, are now higher for the thicker material of all widths, and lower for thinner material in widths from 2 to 6 in. Some consequential increases have been authorized in the prices of the thicker gauges of cold rolled strip.

LECTURES ON EXPORT TRADE PROBLEMS.—Three Cantor lectures on some problems of British export trade will be delivered at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2, on November 20 and 27, and December 4, at 6 p.m. The individual titles, with the names of the lecturers will be as follows: Exports and the Country's Economy (J. L. S. Steel, M.A., J.P., chairman, Overseas Trade Policy Committee, F.B.I.); Production for Export (Reay Geddes, O.B.E., managing director, Dunlop Rubber Co., Ltd.); and Overseas Marketing (Roger Falk, O.B.E., chairman, Marketing Development Co., Ltd.).

DISTINGTON ENGINEERING CO., LTD., a subsidiary of the United Steel Companies, Ltd., The Mount, Broomhill, Sheffield, 10, are to build a vertical continuous casting plant for Scaw Metals, Ltd., Johannesburg, South Africa. Intended for the production of steel billets, the new plant will be constructed in conjunction with Concast, A.G., Zurich, who are associated with the company in the field of continuous casting. Of twin-strand type, the plant will be designed for casting killed carbon and low alloy steels into billets of 2 to 6 in. square cross-section, and will be equipped initially for the production of 3½- and 4-in square billets.

BENTON & STONE, LTD., Aston Brook Street, Birmingham, 6, point out that the ball joints and complete control rods which they have been supplying for many years for such purposes as throttle and ignition control on motor vehicles, have many other applications, for example, for opening and closing light shutters, and for operating valves and switches. Standard assemblies are available in lengths from 6 to 18 in. and special assemblies can be supplied to order. There are also separate control ball joints in spring-loaded, non-adjustable, and adjustable "frictionless" types.

FERRANTI, LTD., Hollinwood, Lancs., and Aron Meters, Ltd., have reached an agreement whereby the former will purchase the Aron electricity metering business, with manufacturing tools and equipment, for £440,000. At present there will be no change in the conduct of the Aron meter business which will continue at Salusbury Road, Kilburn. To avoid confusion, Aron propose shortly to change the name of the company to Astaron Electronics, Ltd., and the name Aron Meters, Ltd., will thus be released for use by a newly formed subsidiary of Ferranti. Under the new title Astaron Electronics will expedite the move to their new factory at Aylesbury.

G.T.M.A. Export Catalogue

The fifth edition of the now well-known Export Catalogue has been published by The Gauge and Tool Makers' Association, Standbrook House, 2-5 Old Bond Street, London, W.1, and is in process of being distributed to actual and potential buyers in many countries, and to British consulates and embassies abroad. It is printed in English, French and Spanish throughout, and there is an opening section concerned with the aims, objects and export activities of the Association. Next, there is a classified buyers' guide to the products of advertising members, and a full list of members. In the section devoted to members' announcements, which occupies the greater part of the catalogue, the various products are briefly described, and many are illustrated.

Copies of the catalogue are obtainable on application to the above address.

Apprentice Prizegiving at NPL

At a recent ceremony held in the Glazebrook Hall at the National Physical Laboratory, Teddington, Middlesex, Professor J. Loxham, C.G.I.A., M.I.Mech.E., M.I.Prod.E., of the College of Aeronautics, Cranfield, Beds., presented prizes to a number of apprentices who are receiving training in the Laboratory. Dr. H. Barrell, D.Sc., A.R.C.S., D.I.C., Superintendent of the Standards Division of the NPL, referred to the work of Professor Loxham in an introductory address and the latter, when presenting the prizes, spoke at some length on various aspects of the valuable training afforded by an apprenticeship at the NPL. He then referred to the impending changes in technological fields which would offer great opportunities to the present generation of apprentices.

Sir Gordon Sutherland, LL.D., Sc., F.R.S., Director of the Laboratory, presented indentures to a number of apprentices who had completed 5-year training periods. Examples of the apprentices' work were on view to the visitors attending the ceremony, and the divisional workshops where apprentices receive training were open for inspection.

Correction

In MACHINERY 99/1069—8/11/61, details were given of a Schaudt grinding machine. We have been asked to point out that these machines are now marketed in this country by Geo. Kingsbury & Co. (Machine Tools), Ltd., 54 Victoria Street, London, S.W.1.

Tarex Exhibition

Tarex (England), Ltd., 22 Buckingham Gate, London, S.W.1, are to hold an exhibition of their machine tools in the private exhibition hall of Rank Precision Industries, Ltd., Harehills Lane, Leeds, 8, from November 20 to 24 inclusive. Tarex TAR-H/64B and TAR-L/42B "short batch" hydro-copying automatics will be on view, and at 11 a.m. and 3 p.m. daily there will be demonstrations to indicate the rapidity with which the set-ups on these machines can be changed over from one component to another. Machines to be demonstrated under production conditions will also include the Tarex TF-1 finishing lathe, and Strohm type M.45 and M.105 precision sliding headstock automatics.

Production engineers wishing to attend the exhibition are invited to communicate with the company at the above address (telephone, Tate Gallery 9197-9).

N.F.E.T.M. Dinner

The annual dinner of the National Federation of Engineers' Tool Manufacturers was held at the Savoy Hotel, London, on November 7. The president of the Federation, Sir Stanley Harley, B.Sc., M.I.Mech.E., M.I.Prod.E., was in the chair, and the guests, who numbered more than 250, included Mr. J. C. Snow, president of the Machine Tool Trades Association, Mr. H. A. R. Binney, C.B., director, British Standards Institution, Mr. G. P. Barrott, M.I.Prod.E., chairman of the Gauge and Tool Makers' Association, and Mr. K. C. Allen, president of the Association of Engineering Distributors. In a short address of welcome to the guests, Sir Stanley Harley stressed the informal nature of the occasion, and Mr. J. C. Snow replied.

Scrap Metals

MIDLANDS.—From October 31 for a period of four months exporting of certain grades of scrap is permitted under Board of Trade licence. The grades in question are compressed baled iron and steel scrap, and iron and steel scrap turnings and borings, none of which must exceed an f.o.b. value of £25 per ton.

So far there has been no big demand for these grades of scrap as Continental buyers now appear themselves to be experiencing a fall in demand for steel, and lower quality material holds little interest for them.

At home, there has been no relaxation of restrictions on deliveries of basic scrap to steelworks, and Midlands consumers are taking only very small tonnages each week of grades No. 1 and 2 heavy steel. Intakes of No. 3 shovelling quality, No. 4 bales, and No. 6 light iron are regular, but tonnages can be fulfilled easily each week from supplies arising locally.

The foundries which use short heavy steel are strictly controlling their intakes each week, and in general, merchants are shearing scrap for stock. Prices for light cast iron scrap have fallen by as much as 10s. per ton, but all grades can be placed in the Midlands.

Bushy turnings are being taken by merchants with crushers, but local demand for crushed turnings remains unaltered. It is possible that some turnings may be exported in the near future, and some relief would thus be afforded to the trade.

The market for high-speed steel scrap is rather weak, and prices circulating are 4d. or 5d. per lb. below those prevailing last month.

On the whole, the trading situation has not changed very much during the past fortnight. It appears that heavy steel will have to be stocked until home markets improve, and grades which can be exported may only move slowly until demand and prices from abroad improve.

BRITISH MACHINE TOOL

Exports of New Machine Tools

Countries	Bar and Chucking Automatics		Vertical Boring Machines		Other Boring Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Capstan and Turret Lathes		Other Lathes	
	Quantity, Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Commonwealth																
India	94 (1)	6,234	—	—	—	—	130 (4)	4,145	224 (2)	15,297	624 (31)	24,042	529 (9)	24,398	871 (7)	58,581
Pakistan	—	—	—	—	—	—	100 (3)	2,042	70 (2)	7,925	179 (13)	8,402	—	—	—	—
Australia	—	—	—	—	398 (2)	14,479	403 (13)	10,998	87 (1)	2,745	556 (9)	29,823	154 (4)	6,341	443 (23)	16,009
New Zealand	—	—	—	—	—	—	310 (20)	7,528	—	—	103 (5)	4,055	47 (2)	2,067	1,183 (48)	33,365
Canada	—	—	297 (2)	9,335	—	—	200 (10)	4,721	—	—	536 (27)	18,379	256 (4)	10,353	291 (9)	8,930
Miscellaneous	—	—	2 (1)	65	— (1)	135	286 (48)	7,799	—	—	253 (33)	8,985	42 (2)	729	318 (20)	10,265
Foreign																
South Africa	—	—	130 (1)	3,630	—	—	90 (24)	1,514	40 (1)	445	231 (23)	7,724	464 (18)	21,609	355 (26)	13,118
Soviet Union	—	—	—	—	—	—	—	—	94 (4)	8,401	152 (7)	15,026	—	—	—	—
Sweden	34 (1)	4,735	—	—	—	—	2 (1)	30	—	—	22 (2)	2,139	388 (12)	20,567	706 (23)	17,712
Norway	—	—	—	—	290 (1)	5,792	158 (1)	4,261	—	—	27 (2)	989	—	—	44 (3)	2,137
Denmark	—	—	—	—	297 (2)	8,105	104 (13)	3,022	—	—	—	—	86 (3)	4,340	98 (9)	4,071
Western Germany	—	—	—	—	—	—	83 (28)	1,177	79 (1)	4,459	115 (9)	15,683	212 (3)	7,496	416 (19)	23,262
Netherlands	—	—	187 (5)	4,395	342 (3)	10,332	57 (8)	3,263	—	—	68 (4)	3,552	158 (6)	4,176	74 (6)	2,710
Belgium	—	—	—	—	—	—	27 (8)	1,808	—	—	143 (5)	8,728	581 (9)	14,201	10 (1)	419
France	40 (1)	2,177	119 (4)	3,372	178 (3)	8,126	4 (2)	279	—	—	222 (7)	19,522	500 (5)	18,233	235 (32)	10,881
Switzerland	—	—	—	—	—	—	85 (10)	3,280	7 (1)	393	224 (6)	10,910	199 (5)	11,832	69 (6)	2,915
Spain	—	—	—	—	—	—	—	—	117 (2)	7,036	363 (6)	18,637	252 (4)	11,720	—	—
Italy	154 (2)	11,892	19 (1)	1,962	—	—	80 (2)	2,185	320 (3)	20,669	267 (13)	13,644	68 (2)	3,078	45 (3)	2,570
U.S. America	—	—	172 (2)	6,722	4 (2)	850	78 (3)	1,924	—	—	338 (13)	25,221	71 (2)	4,242	685 (28)	23,804
Miscellaneous	155 (1)	8,961	148 (3)	5,699	385 (3)	24,169	613 (64)	22,255	541 (9)	45,860	1,016 (64)	64,896	945 (15)	51,961	1,801 (76)	72,665
Total	477 (6)	33,999	1,074 (19)	35,180	1,894 (17)	71,988	2,810 (262)	82,231	1,579 (26)	113,230	3,439 (279)	300,357	4,952 (105)	217,343	7,644 (339)	303,414

Total exports of reconditioned machine tools: Quantity, No. 76; Weight, 5,242 cwt.; Value, £51,787.
Total exports of imported machine tools: Quantity; Weight, 3,538 cwt.; Value, £106,422.

Imports of New Machine Tools

Country of Origin	Bar and Chucking Automatics		Vertical Boring Machines		Other Boring Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Capstan and Turret Lathes		Other Lathes	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Sweden	—	—	—	—	10 (1)	1,136	161 (22)	3,633	—	—	237 (8)	17,641	—	—	178 (7)	7,796
Western Germany	227 (2)	13,422	144 (1)	7,265	753 (5)	43,665	547 (6)	15,378	532 (5)	33,528	1,263 (64)	79,783	688 (16)	47,796	1,721 (34)	65,275
France	—	—	11 (1)	3,965	6 (4)	657	27 (3)	416	—	—	3 (2)	119	—	—	578 (6)	27,491
Switzerland	138 (10)	16,830	107 (2)	9,413	25 (3)	2,690	3 (1)	273	41 (5)	5,601	204 (25)	16,011	216 (4)	16,817	376 (17)	36,161
U.S. America	1,035 (5)	58,571	40 (2)	5,628	289 (5)	22,479	235 (26)	26,392	416 (3)	34,847	1,611 (46)	115,567	190 (3)	18,095	524 (19)	44,301
Miscellaneous	—	—	107 (2)	4,464	460 (5)	14,602	231 (6)	7,012	151 (3)	6,990	978 (61)	35,709	22 (2)	1,115	850 (74)	31,606
Total	1,400 (17)	88,823	409 (8)	30,735	1,543 (23)	85,229	1,204 (64)	53,104	1,140 (16)	80,966	4,296 (206)	264,830	1,116 (25)	83,823	4,227 (157)	212,630

Total imports of reconditioned machine tools: Quantity, No. 69; Weight, 2,638 cwt.; Value, £44,049.

IMPORTS AND EXPORTS (Classified)

and Parts during June, 1961

Milling Machines		Presses		Sheet-metal Working Machines		Sawing Machines		Screwing and Threading Machines		Planing, Shaping and Slotting Machines		Unit Transfer Machines and Heads		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value	Quantity. Cwt. and No.	Value £
1,153 (16)	61,090	609 (7)	14,089	126 (17)	3,500	12 (1)	475	49 (2)	2,809	956 (6)	40,426	—	—	57 (6)	3,200	960	66,278	6,394 (109)	324,564
41 (3)	2,189	42 (2)	1,336	143 (5)	1,494	—	—	—	—	—	—	—	—	35 (2)	6,445	53	2,347	663 (30)	32,180
547 (18)	28,100	319 (4)	6,268	479 (65)	10,863	55 (3)	1,196	95 (6)	4,979	43 (3)	996	2 (6)	310	274 (23)	7,223	998	34,624	4,853 (180)	174,954
296 (9)	13,875	196 (9)	4,183	225 (6)	4,779	44 (9)	1,220	50 (2)	2,000	79 (4)	2,156	—	—	228 (7)	8,448	77	3,020	2,838 (121)	86,696
600 (7)	33,062	427 (4)	9,884	—	—	4 (1)	120	70 (1)	2,842	—	—	—	—	26 (1)	2,600	66	6,558	2,773 (66)	106,784
64 (5)	3,478	351 (16)	9,398	158 (8)	5,059	151 (13)	2,882	26 (2)	918	136 (12)	3,231	—	—	120 (42)	3,696	147	8,796	2,054 (203)	65,436
20 (1)	1,056	379 (12)	9,395	89 (3)	1,074	30 (3)	721	51 (3)	2,024	177 (5)	4,333	—	—	131 (17)	4,047	292	18,108	2,479 (137)	88,798
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	38	246 (11)	23,465
—	—	22 (2)	1,149	2 (12)	50	21 (5)	841	280 (4)	19,582	—	—	— (1)	66	43 (3)	2,855	206	10,744	1,726 (66)	80,470
—	—	3 (1)	167	115 (1)	3,787	—	—	17 (1)	602	—	—	—	—	320 (6)	11,162	74	5,156	1,048 (16)	34,053
62 (4)	3,087	82 (5)	1,688	415 (1)	7,000	— (2)	37	—	—	—	—	—	—	89 (2)	5,270	64	4,986	1,297 (41)	41,606
215 (4)	11,051	496 (4)	23,025	119 (8)	7,129	8 (1)	945	32 (1)	2,454	2 (1)	64	—	—	974 (4)	40,655	206	15,116	2,957 (83)	152,516
—	—	181 (2)	6,724	—	—	—	—	—	—	180 (5)	5,000	—	—	14 (3)	912	289	7,736	1,550 (42)	48,800
607 (5)	34,780	—	—	—	—	—	—	—	—	19 (1)	453	—	—	3 (4)	304	84	8,076	1,474 (33)	68,769
162 (2)	9,342	25 (30)	2,041	4 (2)	447	—	—	63 (2)	5,182	174 (4)	5,079	— (1)	99	166 (2)	10,129	161	21,258	2,057 (97)	116,167
150 (3)	9,101	—	—	—	—	—	—	35 (1)	3,629	—	—	—	—	6 (5)	505	19	3,517	794 (37)	46,082
160 (1)	13,374	—	—	660 (1)	12,382	—	—	—	—	—	—	—	—	247 (1)	12,825	29	3,183	1,828 (15)	79,157
1,135 (22)	33,918	1,003 (2)	46,880	124 (2)	9,539	—	—	134 (3)	8,353	—	—	—	—	563 (3)	20,849	112	12,291	4,024 (58)	187,830
53 (3)	2,254	—	—	54 (80)	1,645	11 (1)	434	57 (1)	3,589	—	—	—	—	1 (1)	50	145	12,524	1,669 (136)	83,259
816 (8)	36,276	1,078 (22)	31,512	385 (12)	16,303	35 (7)	1,885	94 (7)	11,037	570 (14)	13,649	—	—	3,653 (54)	75,915	550	24,322	12,785 (359)	507,365
6,081 (111)	296,033	5,213 (122)	167,739	3,098 (223)	85,051	371 (46)	10,756	1,053 (36)	70,000	2,336 (55)	75,387	2 (8)	475	6,950 (186)	217,090	4,532	268,678	53,505 (1,840)	2,348,951

Figures in parentheses denote number of machines. * Not including machine tool cutting parts.

and Parts during June, 1961

Milling Machines		Presses		Sheet-metal Working Machines		Sawing Machines		Screwing and Threading Machines		Planing, Shaping and Slotting Machines		Unit Transfer Machines and Heads		Other Machines		Machine Tool Parts*		Total	
Quantity, Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
128 (4)	6,488	23 (1)	408	67 (4)	2,344	6 (1)	199	4 (1)	325	—	—	—	—	118 (8)	5,691	61	6,191	993 (57)	51,852
2,039 (22)	88,877	4,610 (14)	124,755	666 (35)	36,905	480 (54)	18,443	311 (35)	18,640	82 (2)	2,503	16 (1)	1,556	2,500 (77)	141,269	581	67,084	17,160 (373)	806,144
1,156 (19)	55,686	725 (11)	17,107	—	—	12 (4)	391	240 (3)	18,817	—	—	—	—	324 (12)	25,723	174	12,785	3,256 (65)	163,157
213 (7)	16,043	179 (3)	5,492	3 (1)	232	17 (5)	1,207	—	—	—	—	—	—	348 (21)	39,273	147	29,498	2,017 (104)	195,541
572 (7)	30,990	702 (6)	33,508	437 (17)	17,959	21 (1)	995	240 (5)	8,524	505 (3)	38,269	867 (1)	93,360	909 (24)	54,327	1,882	200,526	10,475 (173)	804,338
4,220 (53)	148,545	912 (40)	19,040	763 (15)	27,406	120 (7)	3,386	137 (4)	7,740	55 (1)	998	—	—	132 (32)	7,061	941	48,896	10,079 (305)	364,570
8,328 (112)	346,629	7,151 (75)	200,310	1,936 (72)	84,846	656 (72)	24,621	932 (48)	54,046	642 (6)	41,770	883 (2)	94,916	4,331 (174)	273,344	3,786	364,980	43,980 (1,077)	2,385,602

Figures in parentheses denote number of machines. * Not including machine tool cutting parts.

Coming Events

Institution of Production Engineers. *Derby Section.* November 24, at 7 p.m., in the Louis Room, St. James's Restaurant, St. James's Street, Derby; lecture on "Training Foreman," by D. B. Beynon. *Manchester Senior and Graduate Sections.* November 21, at 7.15 p.m., in Reynolds Hall, Manchester College of Science and Technology, Sackville Street, Manchester; lecture on "Application of Metal Deposition," by W. E. Ballard. *Luton Section.* November 21, at 7.30 p.m., at Half-Way House, Dunstable Road, Luton; lecture on "Static Switching Applied to Machine Tool Control," by W. G. Turner. *London-Brighton Group.* November 22, at 7 p.m., at A.P.V. Crawley; lecture on "A Review of New Techniques in the Manipulation of Metals," by G. G. Dewsnap. *Stoke-on-Trent Section.* November 23, at 7.30 p.m., at the Grand Hotel, Hanley, Stoke-on-Trent; lecture on "Trade Unions and their Approach to Productivity," by R. Slater.

The Institute of Metal Finishing. *South-West Section.* November 21, at 7.30 p.m., at the Royal Hotel Bristol; lecture on "Solutions for Hard Chromium Plating," by D. N. Layton.

Machine Tool Share Market

Stock markets were irregular, with generally quiet conditions during the period under review, although on balance the position as regards prices was more satisfactory. The main centre of interest was the gilt-edged section, where British Government and similar fixed interest stocks were in demand at improving levels.

Commercial and industrial share markets after being quiet and mainly dull became fairly active and firm, and the period closed on a good note.

Among machine tool issues, Edgar Allen advanced 1s. 3d. to 32s.; Arnott & Harrison, 6d. to 11s.; Birmingham Small Arms, 1s. to 21s.; Broom & Wade, 3d. to 25s. 3d.; Chas. Churchill, 1½d. to 8s. 7½d.; Geo. Cohen, 6d. to 10s.; Coventry Gauge & Tool, 4½d. to 29s. 3d.; H. W. Kearns, 1s. to 22s. 3d.; Kerry's (Gt. Britain), 9d. to 8s. 6d.; W. E. Norton (Holdings), 6d. to 8s. 6d.; Sanderson Kayser, 1s. to 34s. 9d.; Ambrose Shardlow, 1s. 3d. to 52s. 6d.; Sheffield Twist Drill, 2s. to 21s. 6d.; and Tap & Die Corporation, 1s 3d. to 17s. 9d.

On the other hand, British Oxygen lost 1s. 6d. at 16s.; Craven Bros. (Manchester), 1½d. at 8s. 6d.; and Samuel Osborn, 1s. at 50s.

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/3
Allen (Edgar) & Co., Ltd.	Ord.	£1	32/-
" " "	5% Prf.	£1	13/3
Arnott & Harrison, Ltd.	Ord.	4/-	11/-
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	10/-
" " "	6% Cum. Prf.	£1	16/6
Birmingham Small Arms Co., Ltd.	Ord.	10/-	21/-
" " "	5% Cum. "A" Prf.	£1	12/6
" " "	6% Cum. "B" Prf.	£1	16/-
" " "	4% 1st Mort. Deb.	Stk.	91½
British Oxygen Co., Ltd.	Ord.	5/-	16/-
" " "	6% Cum. Prf.	£1	18/6
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	8/-
Broom & Wade, Ltd.	Ord.	5/-	25/3
" "	6% Cum. Prf.	£1	16/-
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	14/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/-
Butler Machine Tool Co., Ltd.	Ord.	5/-	15/-
" " " "	5% Cum. Prf.	£1	12/6
Churchill (Charles) & Co., Ltd.	Ord.	2/-	8/7½
" " "	6% Cum. Prf.	£1	25/7½‡
Clarkson (Engrs.), Ltd.	Ord.	1/-	6/3
Cohen (George), 600 Group, Ltd.	Ord.	5/-	10/-
" " "	4½% Cum. Prf.	£1	12/-
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	29/3
" " "	5% Cum. Red. Prf.	£1	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	8/6
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/6
" "	4½% Red. Cum. Prf.	£1	11/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	10/-
Greenwood & Batley, Ltd.	Ord.	10/-	14/3
Harper (John) & Co., Ltd.	Ord.	5/-	7/9
" " "	4½% Red. Cum. Pref.	£1	9/6

COMPANY		Denom.	Middle Price
Herbert (Alfred), Ltd.	Ord.	£1	61/-
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	20/-
" "	"B" Ord.	5/-	15/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	25/-
" " "	7% Cum. Prf.	5/-	4/6
Kearney & Trecker-C.V.A., Ltd.	5½% Red. Cum. Prf.	£1	8/9
" " "	Prefd. Ord.	£1	13/9
Kearns (H. W.) & Co., Ltd.	Ord.	5/-	22/3
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	8/6
Macreadys Metal Co., Ltd.	Ord.	5/-	15/-
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/6xd
Massey (B. & S.), Ltd.	Ord.	5/-	11/-
Newall Engineering Co., Ltd.	Ord.	2/-	7/-
Newman Industries, Ltd.	Ord.	2/-	7/-
" "	6% Prf. Ord.	5/-	5/-
Noble & Lund, Ltd.	Ord.	2/-	5/-
Norton, W. E. (Holdings), Ltd.	Ord.	2/-	8/6
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	50/-
" " " "	5½% Cum. Prf.	£1	22/-
Pratt (F.) Engineering Corporation, Ltd.	Ord.	5/-	14/6
Sanderson Kayser, Ltd.	Ord.	10/-	34/9xd
" "	6½% Cum. Prf.	£1	16/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	7/3
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	52/6
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	14/6
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	21/6
" " "	5% Cum. Prf.	£1	13/3
Stedall & Co., Ltd.	Ord.	5/-	7/6
Sykes (W. E.), Ltd.	"B" non-voting Ord.	10/-	24/3
Tap & Die Corporation, Ltd.	Ord.	5/-	17/9
" " "	4½% Deb. 1961-1977	Stk.	81½
Wadkin, Ltd.	Ord.	10/-	26/-
Ward (Thos W.), Ltd.	Ord.	£1	66/3
" "	5% Cum. 1st Pref.	£1	13/6
" "	5% Cum. 2nd Pref.	£1	20/-
Willson Lathes, Ltd.	Ord.	1/-	2/6

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. ‡ Birmingham price.

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Feed (12)..................$\frac{1}{8}$in.—$23\frac{5}{8}$in.
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Spindle taper......................No. 50
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Power ....$9\frac{1}{2}$ h.p.
Weight .... 48 cwt.

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Motor .... 3 h.p
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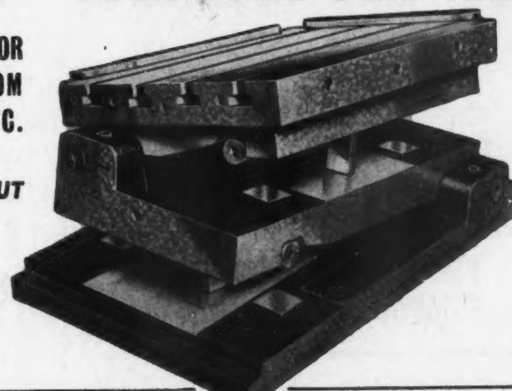

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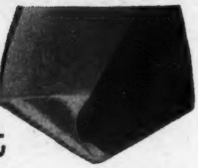

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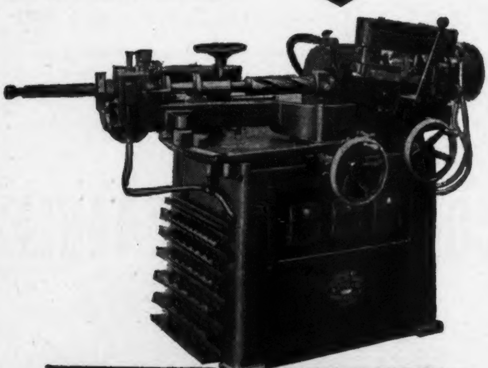

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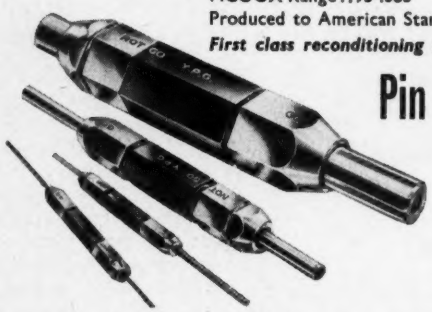

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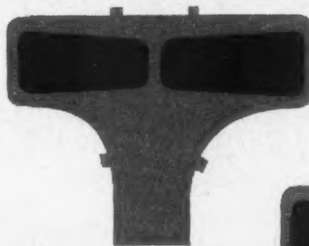

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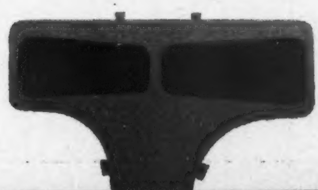

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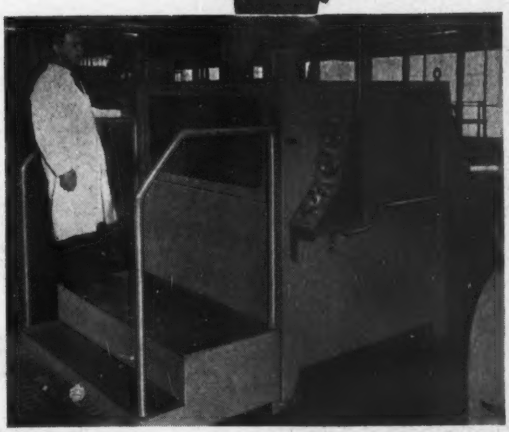

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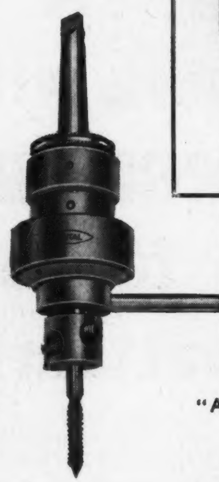

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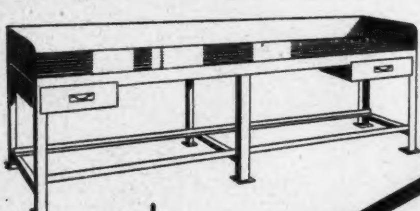

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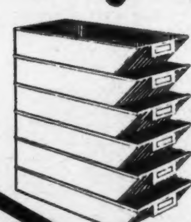

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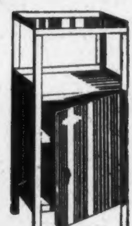

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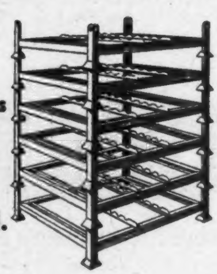

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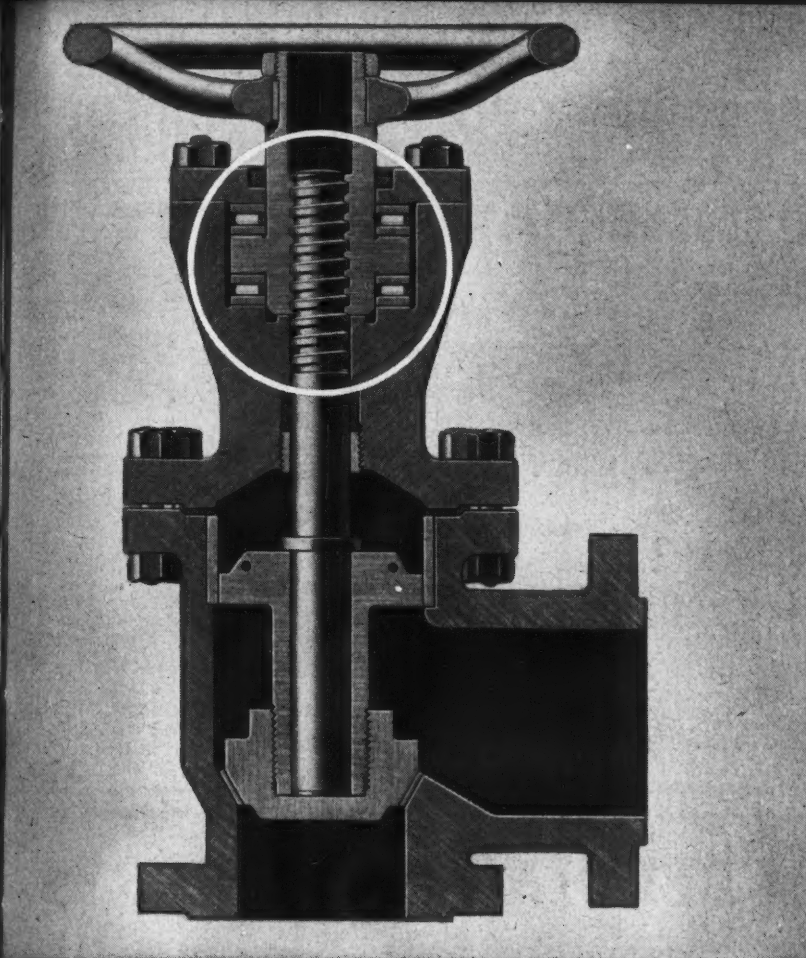

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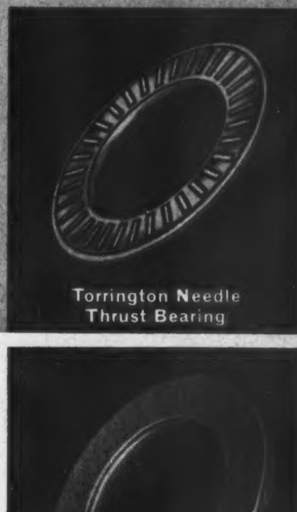

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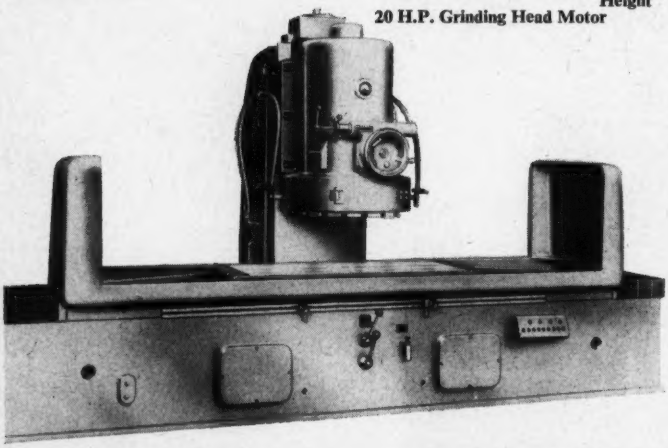

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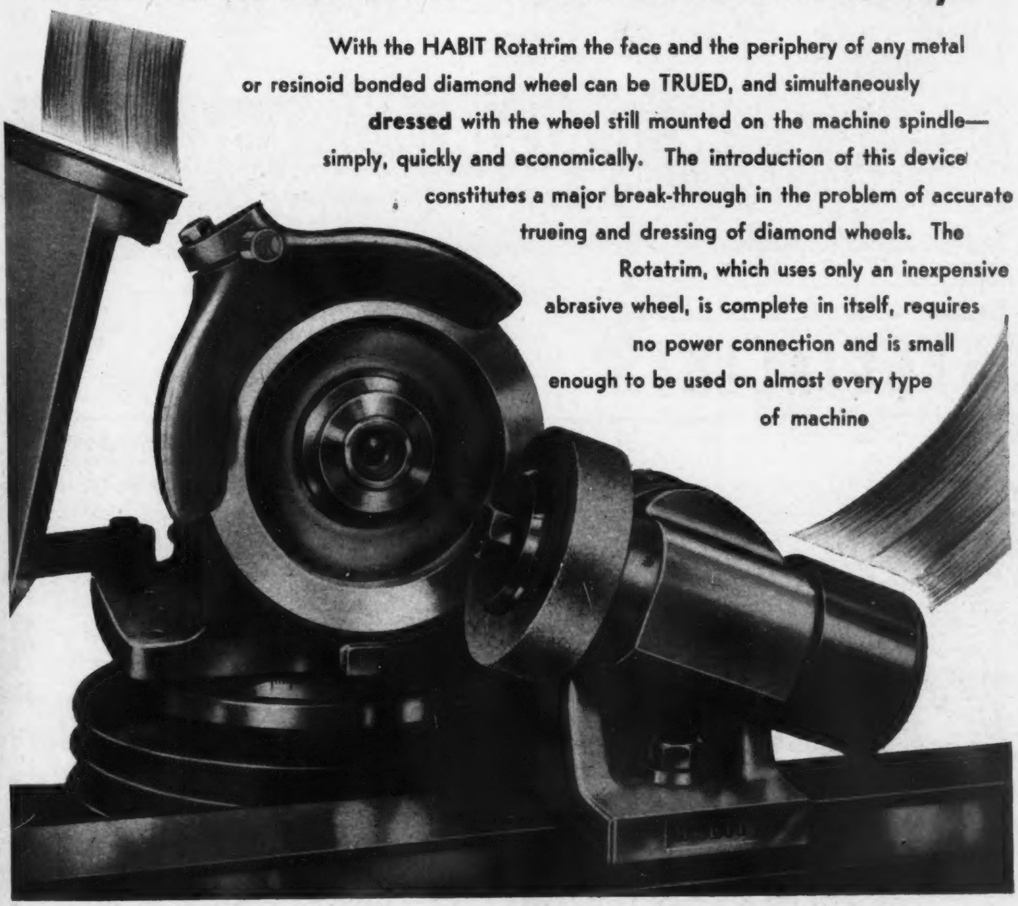

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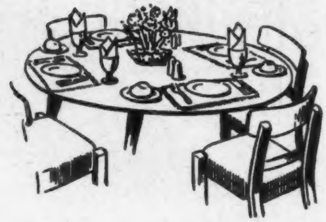

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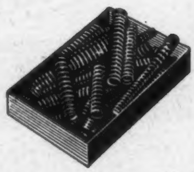

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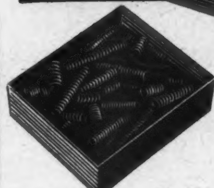

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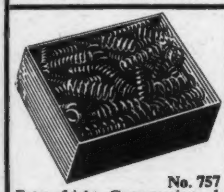

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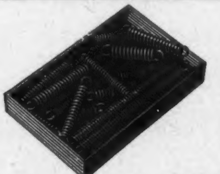

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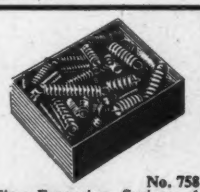

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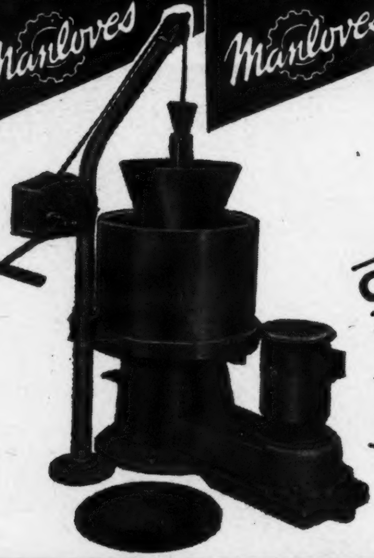

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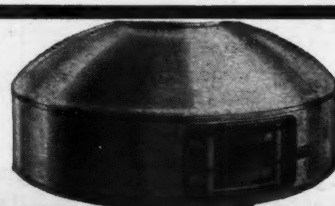

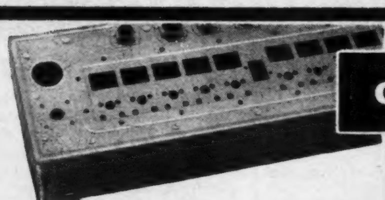

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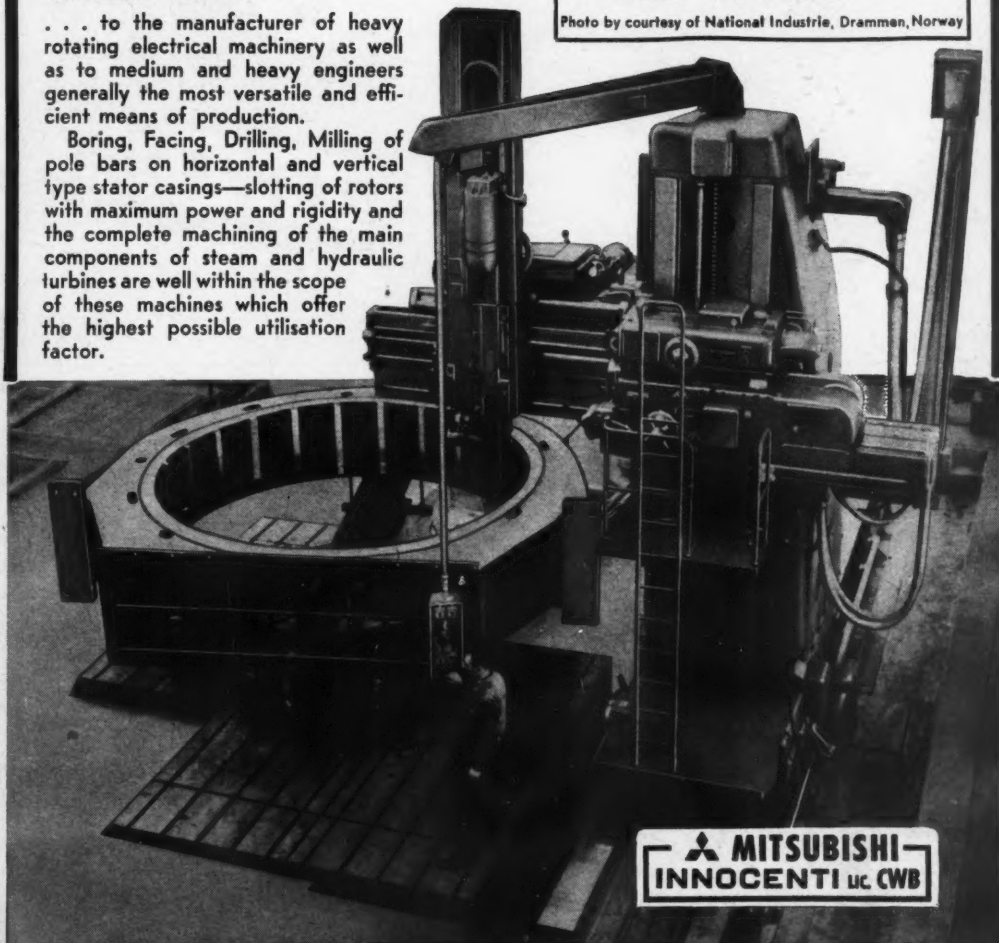

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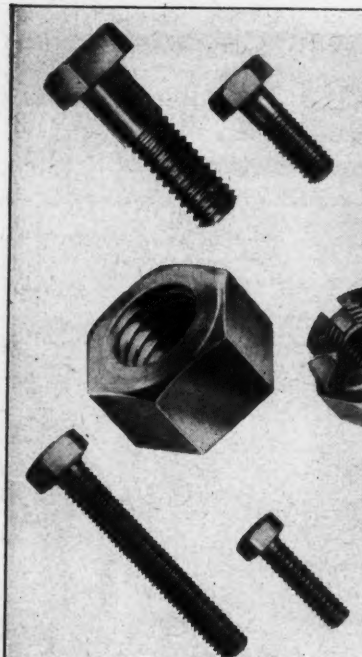

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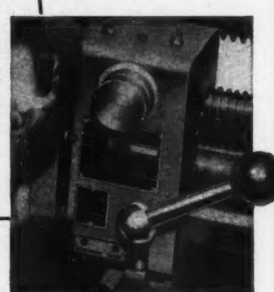

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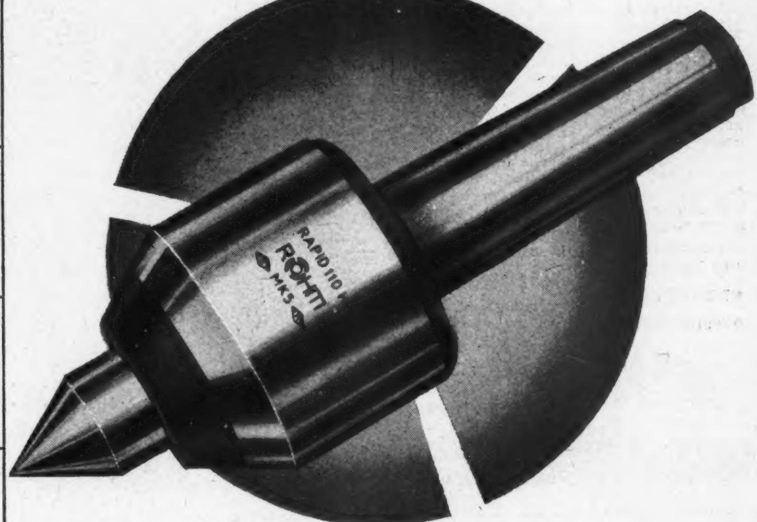

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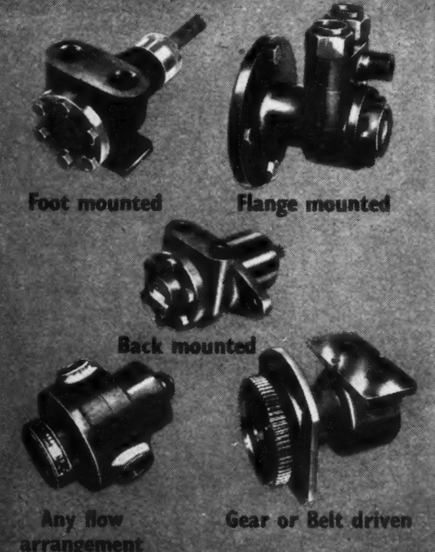

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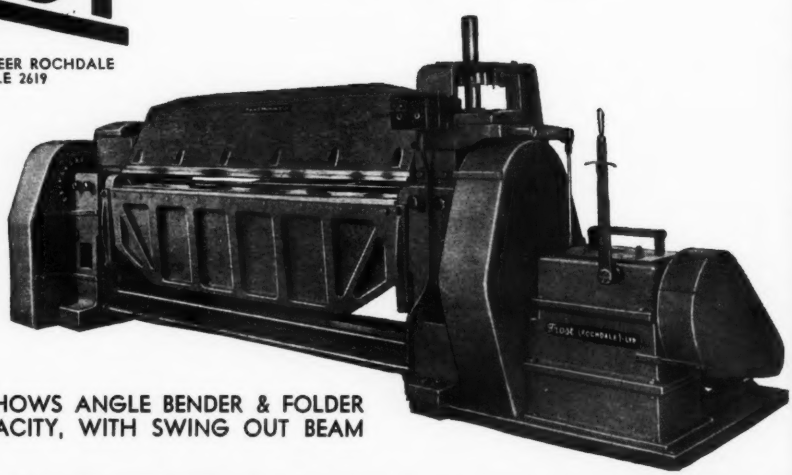

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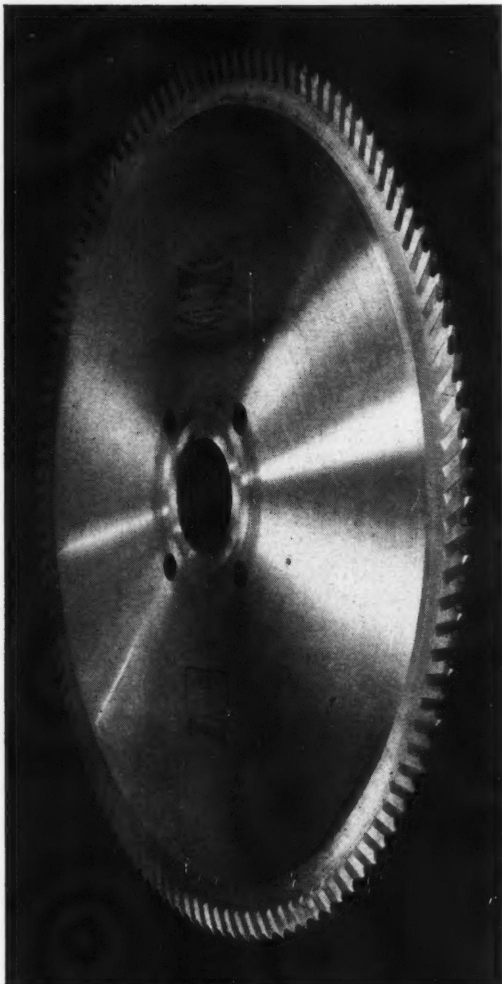

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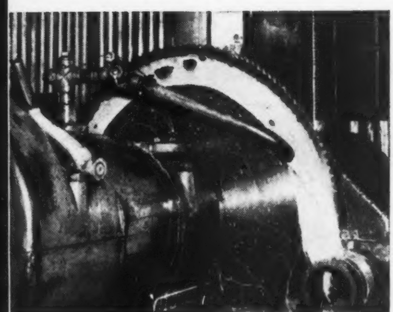

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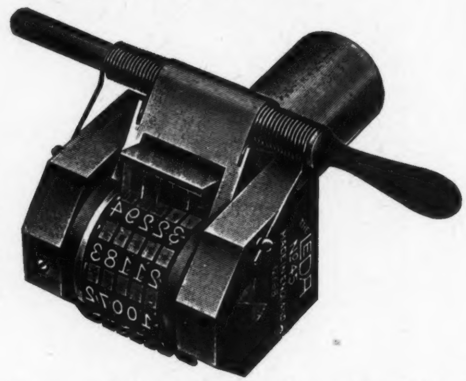

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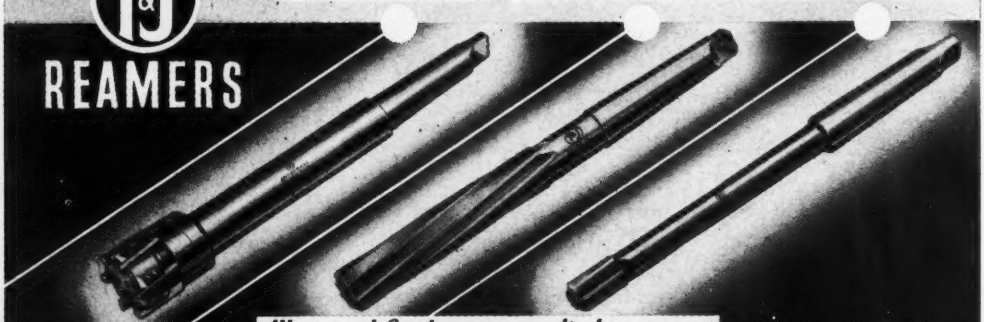

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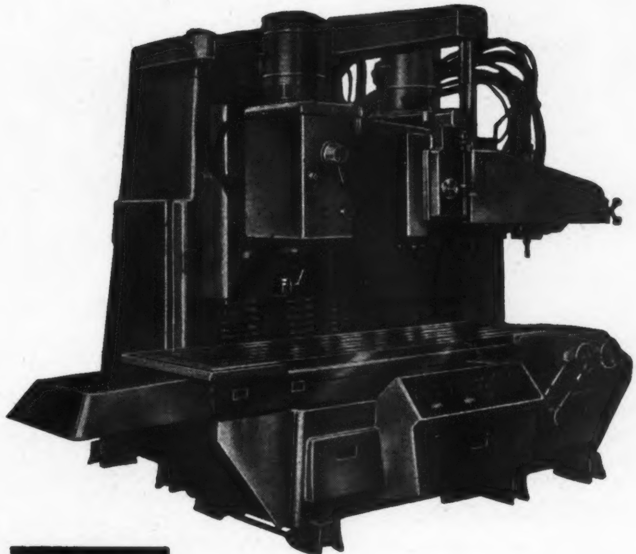

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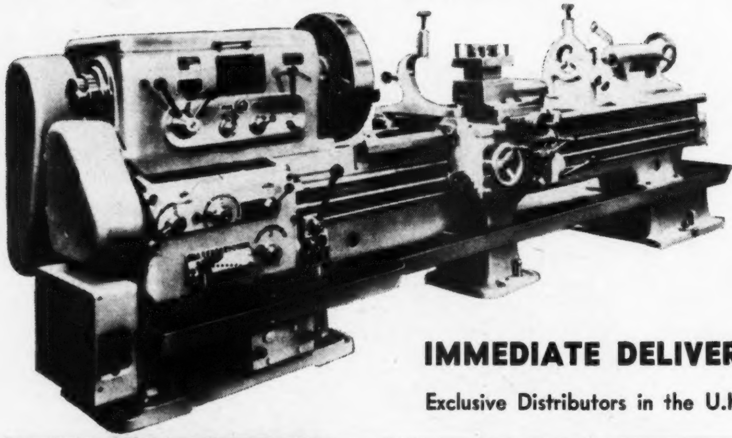

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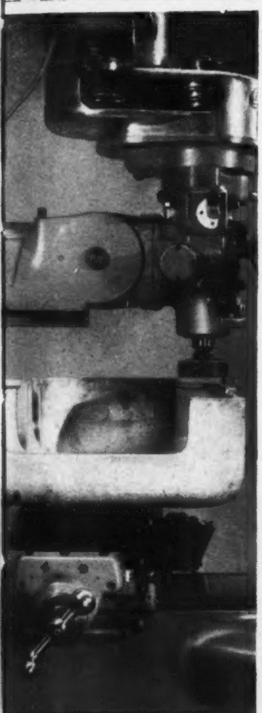

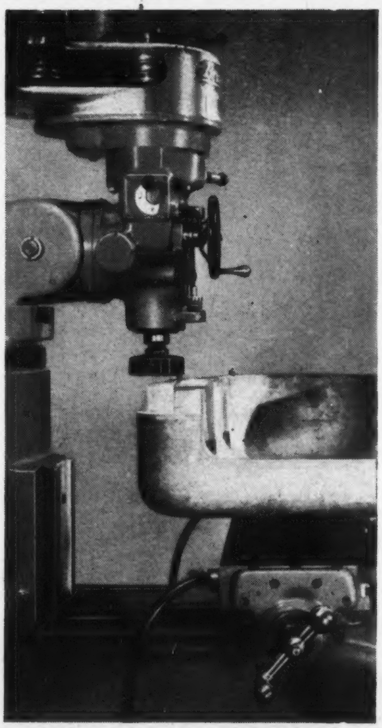

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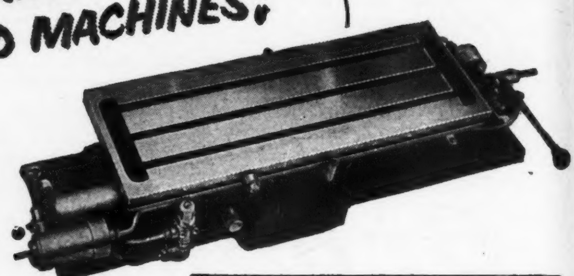

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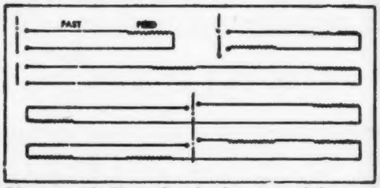

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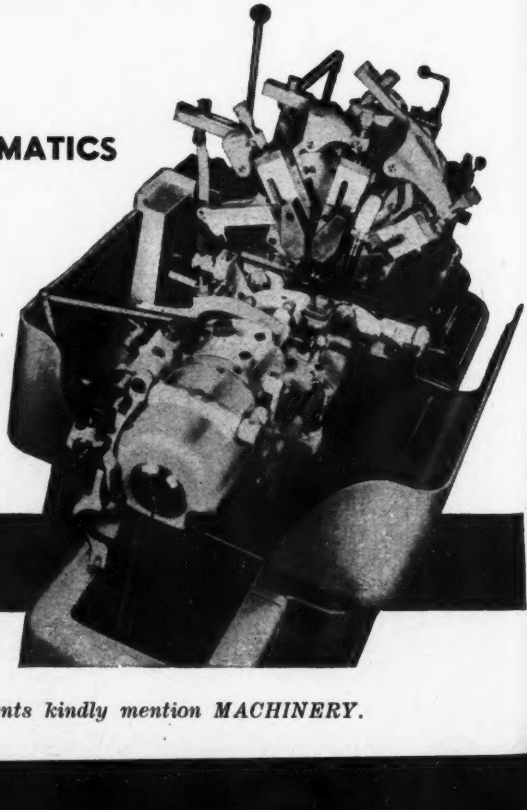

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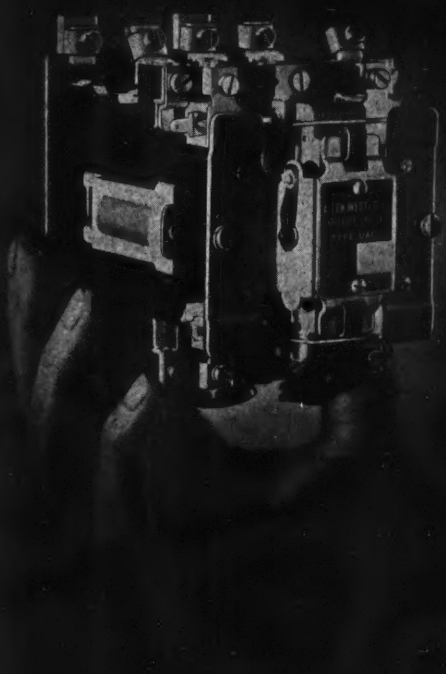

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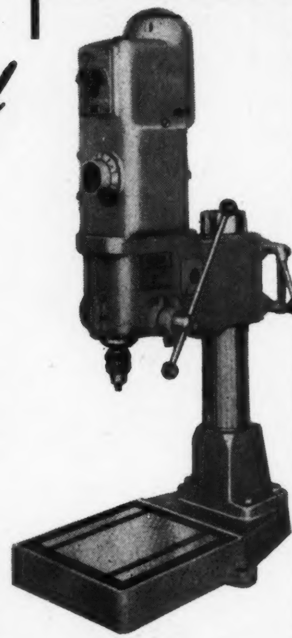

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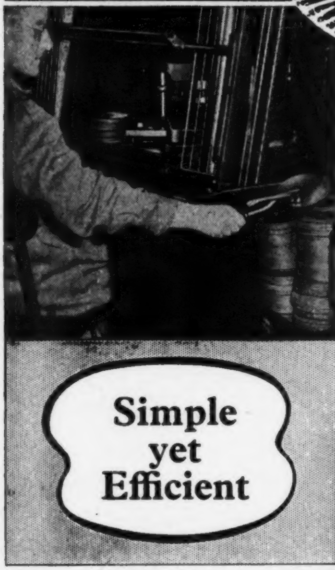

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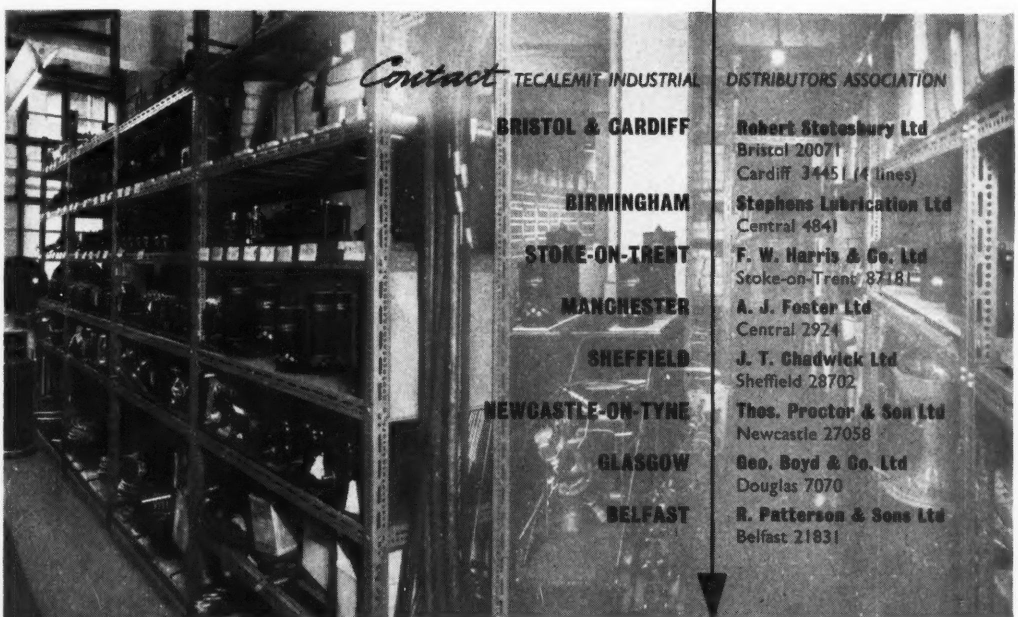

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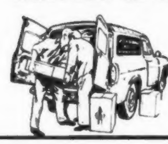

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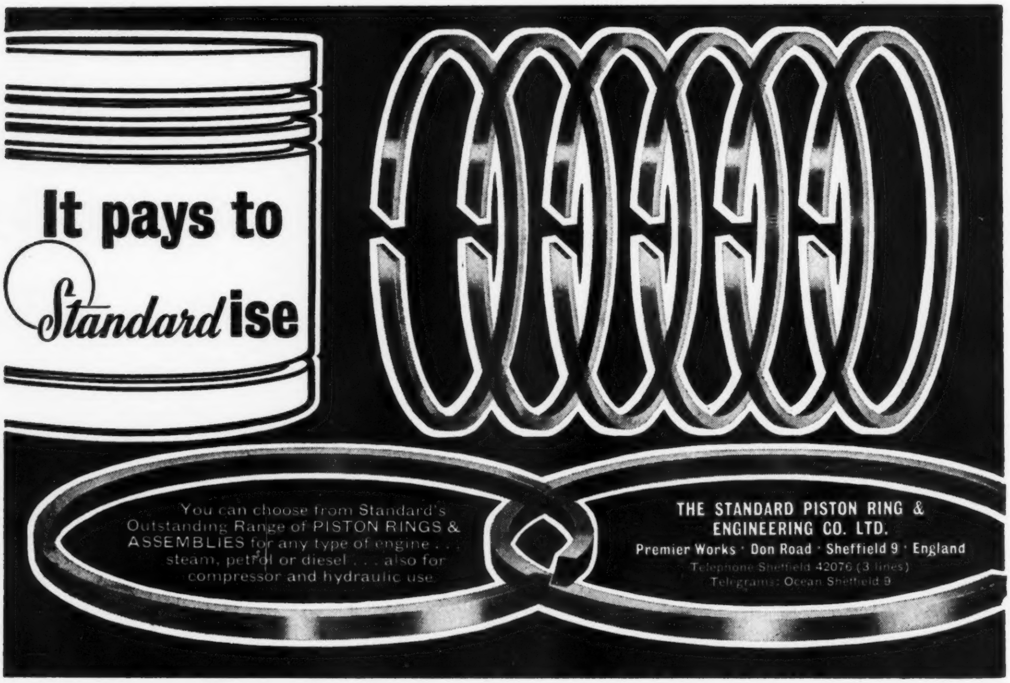
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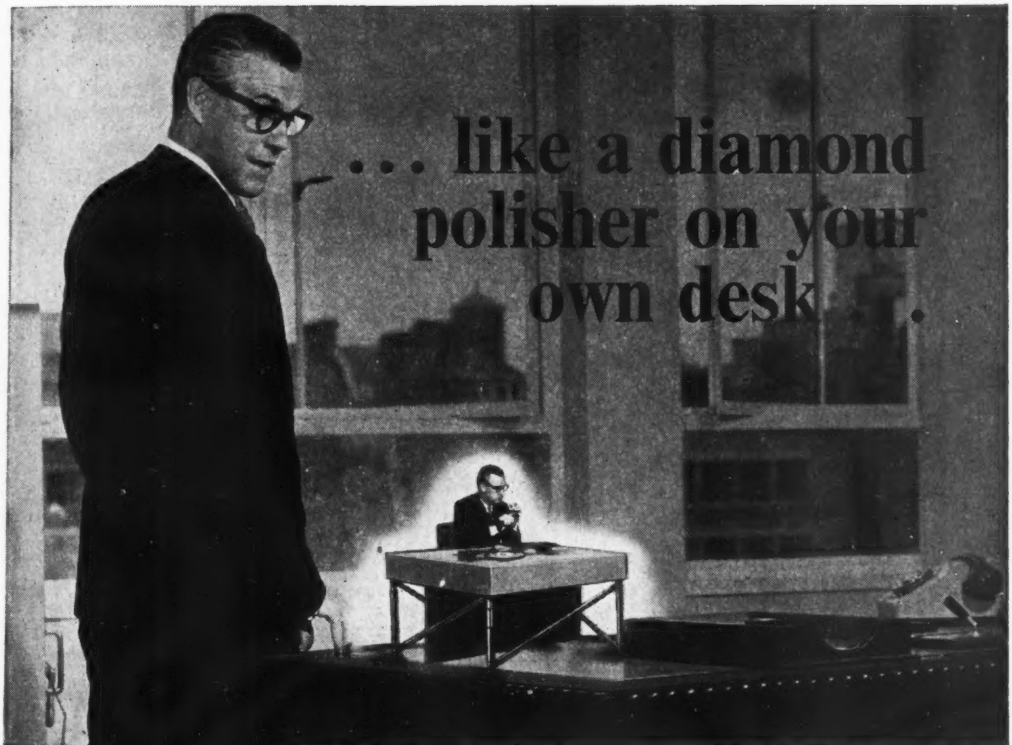

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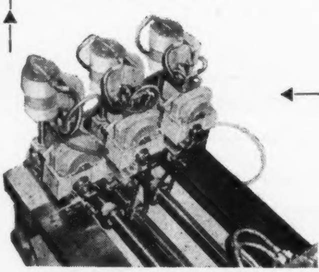

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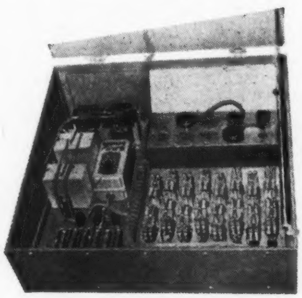
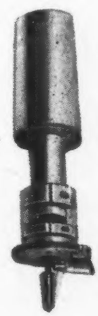


CONTROL CABINET

B



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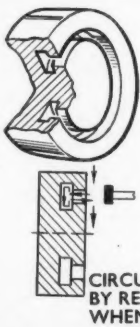

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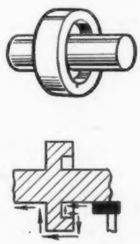

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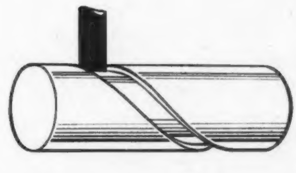

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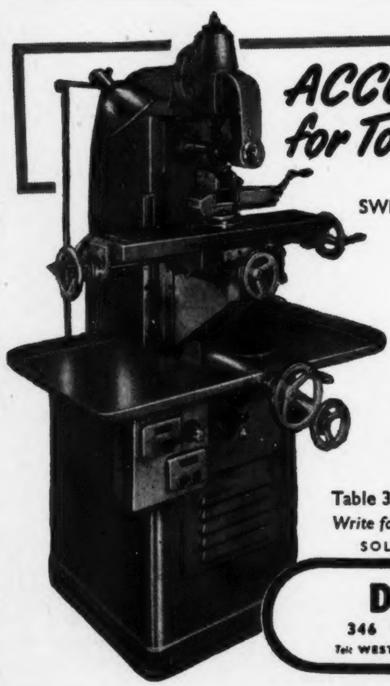

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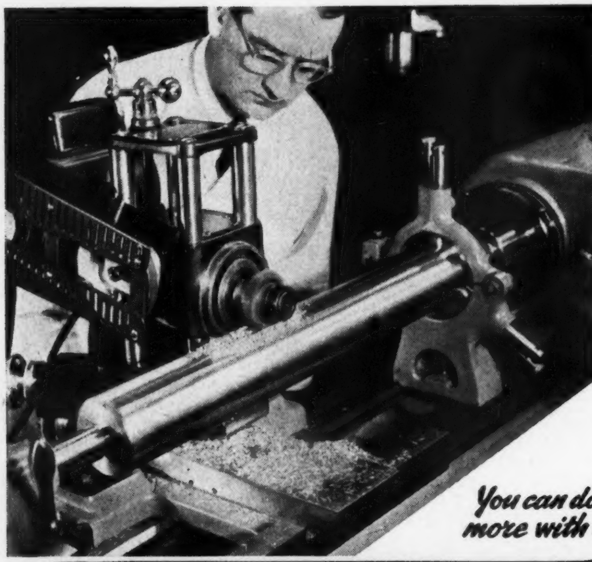

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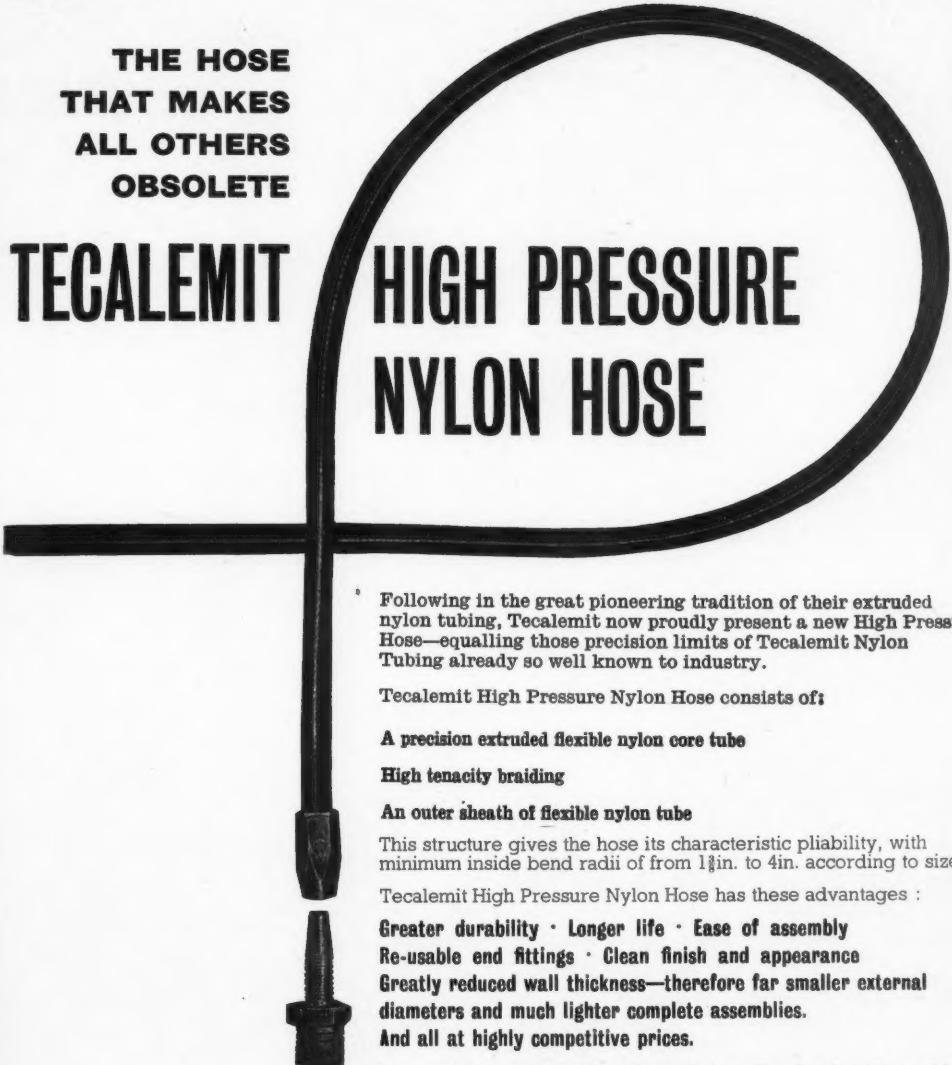

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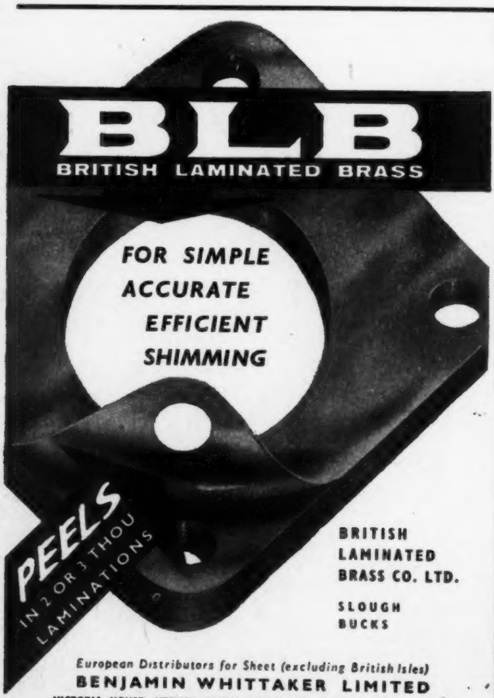

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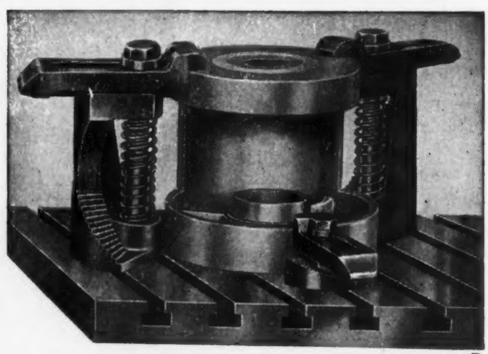

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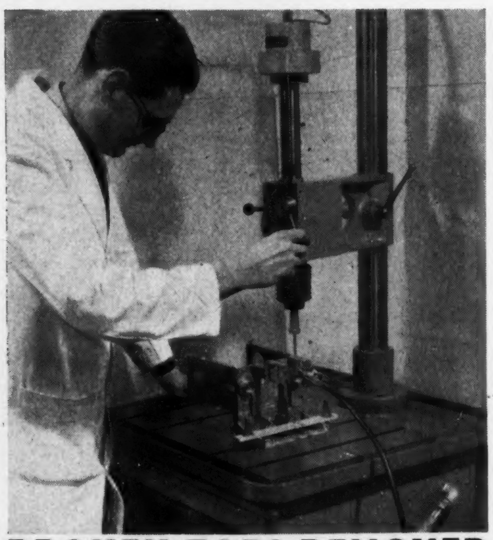

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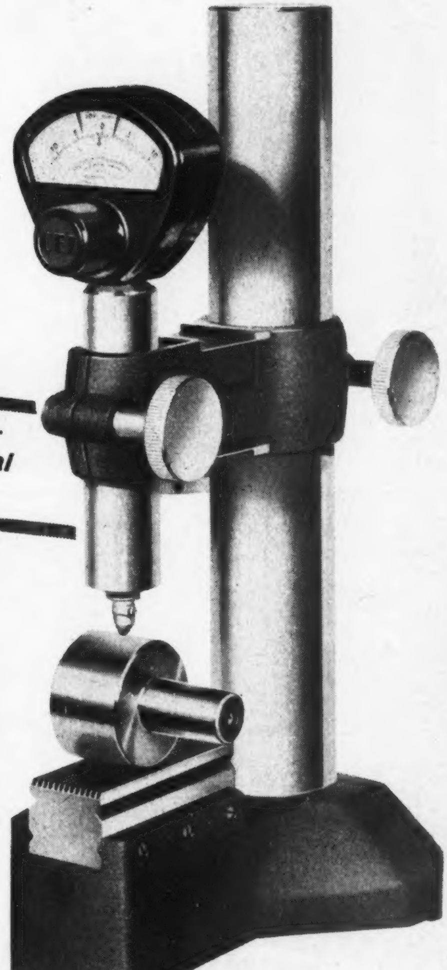

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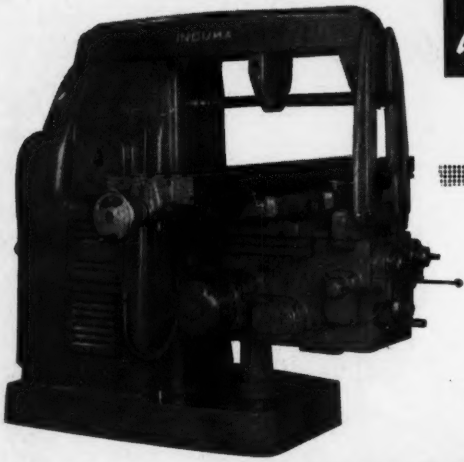

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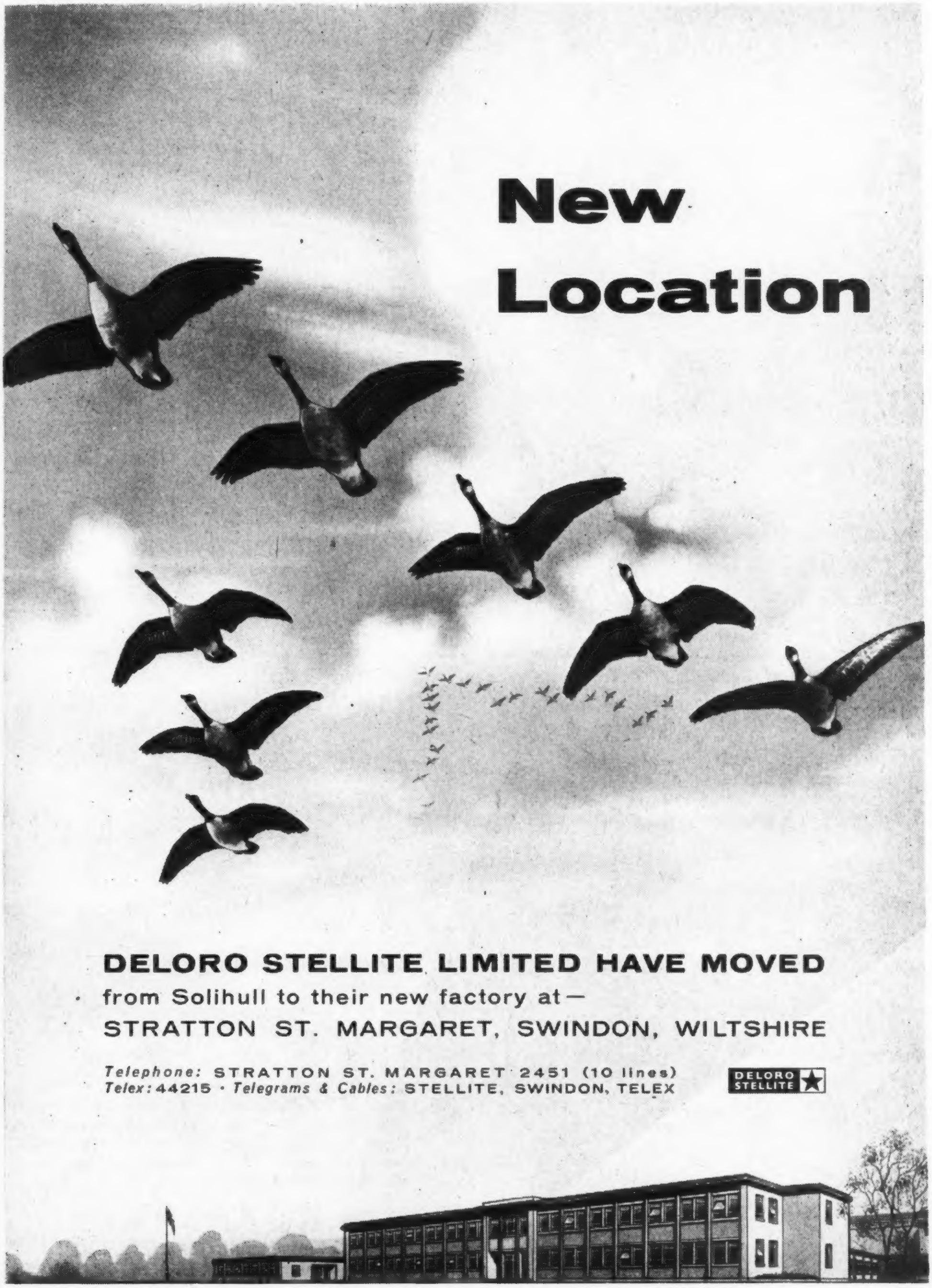

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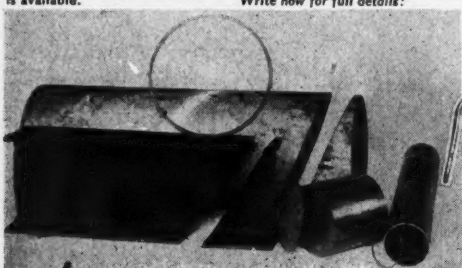

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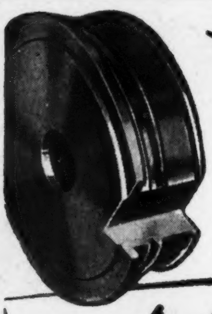

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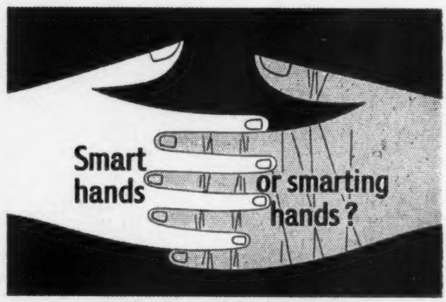

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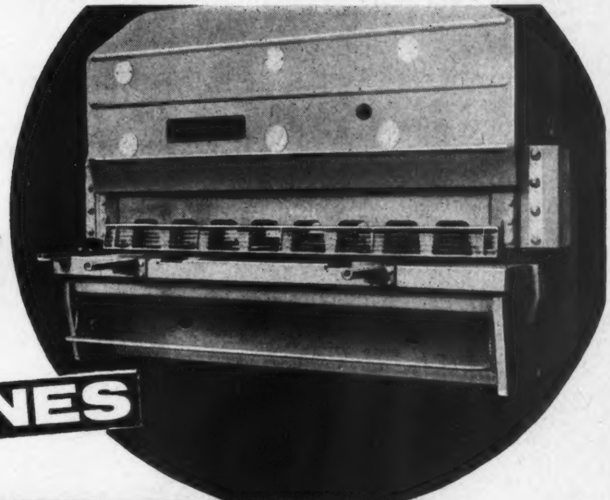

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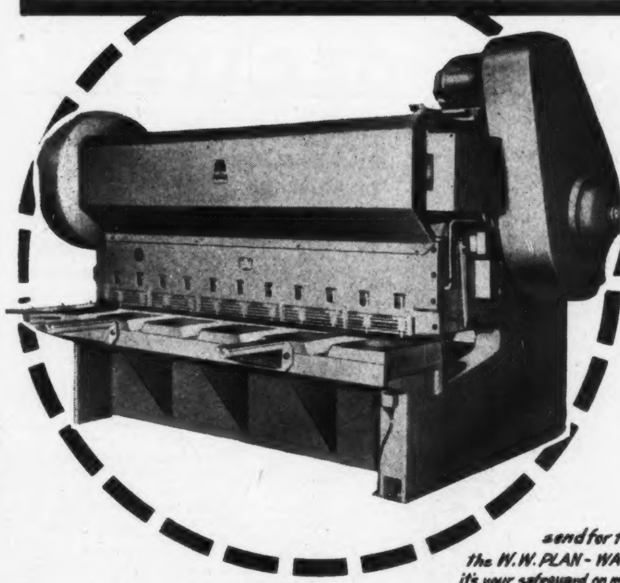

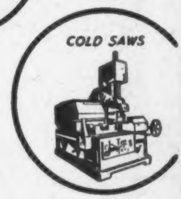

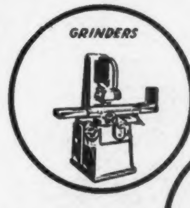

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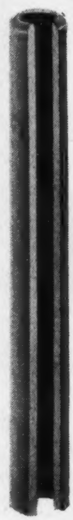

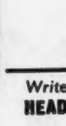

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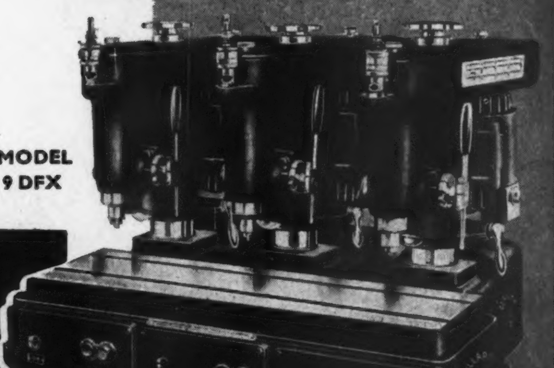

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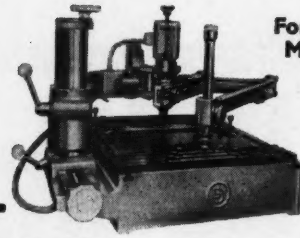

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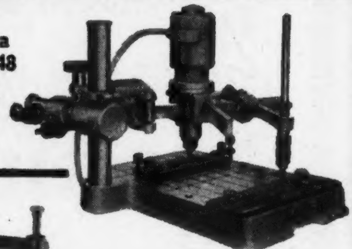

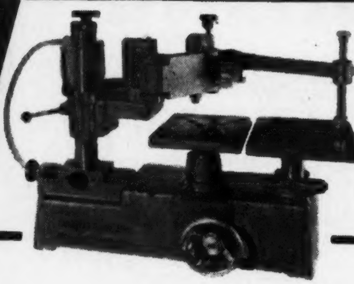

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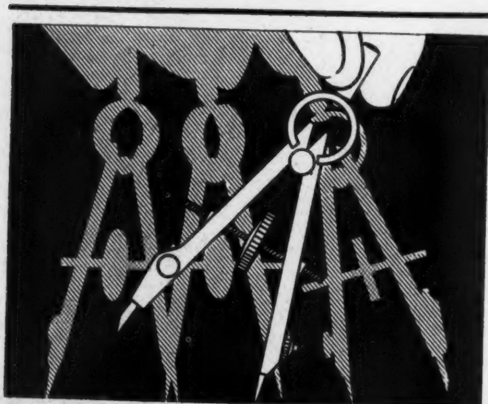

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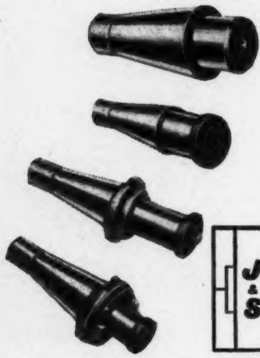

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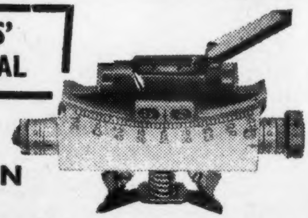

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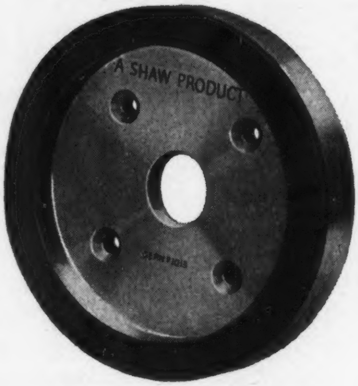

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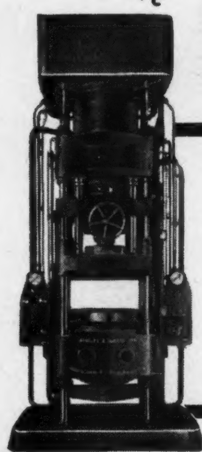

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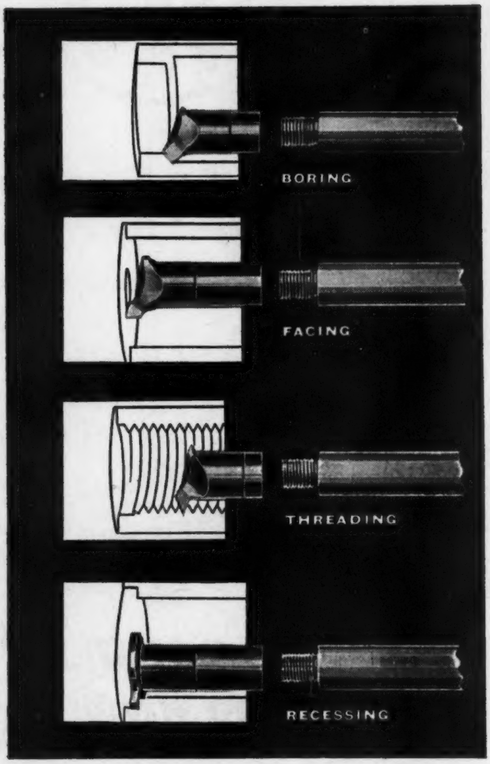

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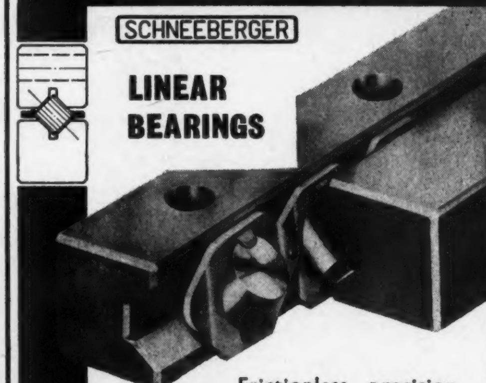

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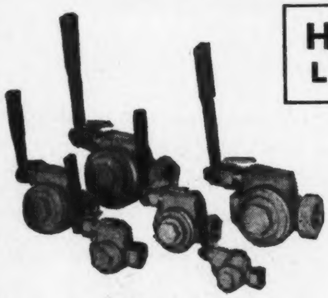

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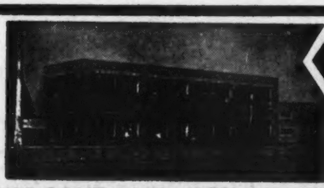

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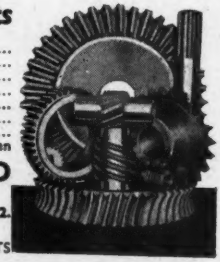

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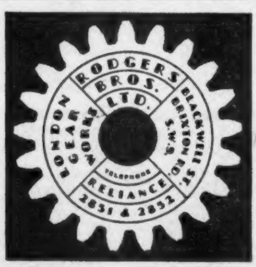

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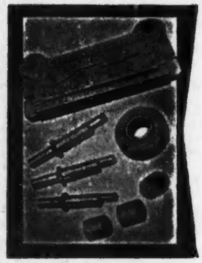

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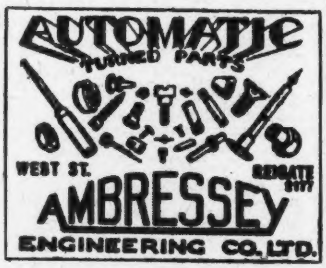

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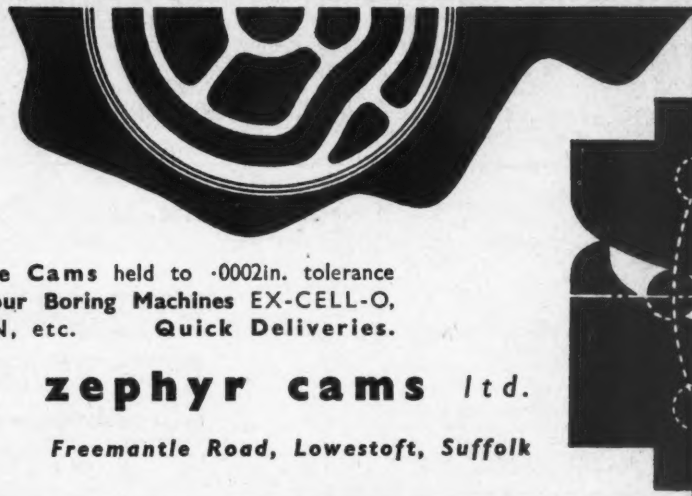

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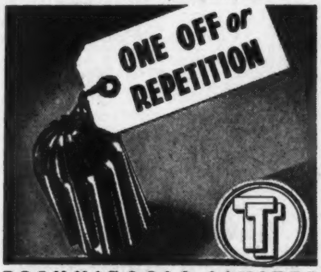

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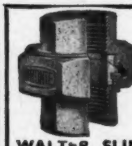

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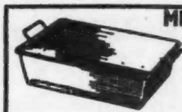

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S & V

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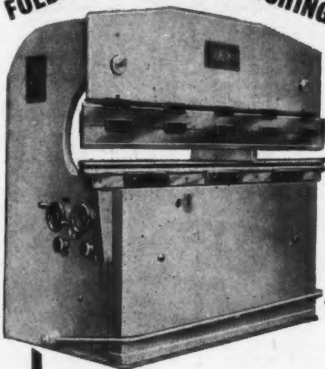

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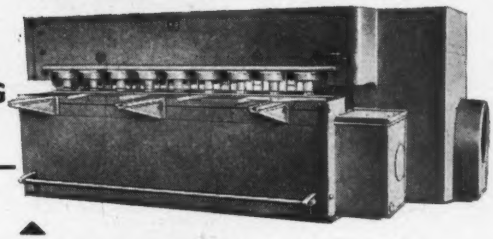

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KITCHEN & WADE 6ft. Girder Type Radial Drilling Machine, 18 spindle speeds, 6 feeds. No. 5 M.T. spindle.

PROGRESS 4E Pillar Drilling Machine, No. 3 M.T. spindle.

BORING MACHINES

ASQUITH Floor Type Horizontal Borer, 3in. diameter travelling spindle, swivelling column with 6ft. × 5ft. tee-slotted bedplate.

SLOTTING MACHINE

ORMEROD 12in. stroke Slotting Machine, 27in. dia. rotary table.

LATHES

LANG 20in. swing Surfacing and Boring Lathe, with hexagon turret.

COLCHESTER 8½in. Mascot S.S. & S.C. Gap Bed Lathes, to admit 6ft. 6in. between centres.

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CRAVEN 15in. S.S. & S.C. Lathe, to admit 25ft. between centres. Two saddles.

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MILLING MACHINES

CINCINNATI Model 1/18in. Production Milling Machine, table 35½in. × 10in., with automatic feed cycle.

ST. ANDRE Horizontal type Heavy Duty Plain Milling Machine, table size 73in. × 16½in.

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CINCINNATI Model 3/36 Hydromatic Milling Machine, table 54in. × 14in.

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CINCINNATI 10 ton Vert. Single Ram Hydraulic Surface Broaching Machine, 66in. stroke, 20in. × 20in. table.

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COVEL No. 12 Tool and Cutter Grinding Machine, with face milling attachment, swing 10in. over table, grinding length 16in.

LANDIS 10in. × 24in. Universal Grinding Machine, with hydraulic feed and internal grinding attachment.

NORTON 18in. × 6in. Hydraulic Horizontal Spindle Surface Grinding Machine.

JONES & SHIPMAN Fig. 540 18in. × 6in. Hydraulic Horizontal Spindle Surface Grinding Machine, with 14in. × 6in. magnetic chuck.

CHURCHILL 16in. × 36in. Model PRH Universal Grinding Machine, with hydraulic feed and internal grinding attachment.

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H.M.E. 100 tons Geared Rigid Power Press, with adjustable stroke 1in. to 6in.

New **BUTTERLEY** No. 4 20 Ton Ungeared Power Press, 1in.-3in. adjustable stroke.

SAWING MACHINE

NOBLE & LUND 11/16in. Cold Circular Sawing Machine, with hydraulic vice, capacity 5in. diameter rounds, 4½in. squares, 9in. × 3½in. beams.

SCREWING MACHINES

KENDALL & GENT 3-2 Tangential Head Screwing Machine, to screw bolts up to 2in. outside diameter, tubes up to 3in. inside diameter, machine fitted with leadscrew.

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ORMEROD 18in. stroke Shaping Machine, 9 ram speeds.

MISCELLANEOUS

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LIECHTI PR Turret Lathe (Swiss).
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FOSTER No. 2B Turret Lathe.

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V. & O. No. 11 Double Action. Approx. 10 tons. Roll feed. Max. draw 1in.

MISCELLANEOUS

NOBLE & LUND 11/16in. Fluifeed Cold Saw, fitted with pneumatic vice for tubes.
RICHMOND 4in. Light Duty Slotter.
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LE BLOND 20in. Rapid Production Lathe, admit 7ft. between centres.

LANG 26in. swing Surfacing and Boring and Screwcutting Lathe, hexagon turret, 3⅝in. hollow spindle.

MILLING MACHINES

PEDERSEN Horizontal Miller, table 49in. × 10in. capacity 24in. × 7½in. × 16in.

ADCOCK & SHIPLEY 1AD Horizontal Miller; table 19in. × 7in.; capacity 10in. × 6in. × 10in.; 50-2,500 r.p.m.

EDGWICK No. 2 Dial Type Horizontal Miller, table 46in. × 11in., capacity 25in. × 7in. × 17in.

COCHRANE-BLY No. 14 Duplex Universal Vertical Milling and Shaping Machine, table 29in. × 9in., main head swivel 360 deg., shaper ram stroke 0in.-6in.

KENT-OWENS No. 1-14 Production Miller, table 32in. × 9in., hydraulic feed and rapid traverse.

KENT-OWENS No. 1-8 Production Miller, table 25in. × 9in. U.S. Model MM5 Multi-Production Miller, table 21½in. × 6in.

HERBERT No. 46V Vertical Milling Machine, table 58in. × 15in., auto longitudinal feed 36in.

NEW Vertical Millers, with swivel head, table 33½in. × 10in., speeds 90 to 1,500 r.p.m.

CINCINNATI 08 High Speed Vertical Miller with power feed and rapid traverse, table 20in. × 6in., speed 150-1,300 r.p.m.

REED PRENTICE No. 3V.G. High Speed Vertical Millers; 36in. × 10in. table; capacity 24in. × 12in. × 18in.

REED PRENTICE No. 2 Vertical Miller, 20in. × 8⅜in. table, capacity 16in. × 11in. × 15in.; 3,330 r.p.m.

BROWN & SHARPE No. 2 Vertical Miller, swivel head, table 45in. × 10in., capacity 28in. × 10in. × 15in.

CURD NUBE 2-spindle Vertical Profile Miller, table 17½in. × 14½in.

PROGRESS Universal Milling Machine, table 40in. × 10in.; capacity 24in. × 9in. × 18in.

VICTORIA U1 Universal Miller, table 40in. × 11in.; capacity 25in. × 8in. × 16in., speeds 31 to 1,010.

VICTORIA U2 Universal Milling Machine, table 45in. × 11in., with vertical milling attachment, slotting attachment and rotary table.

MILWAUKEE 2K Universal Miller, table 56in. × 12in., capacity 28in. × 10in. × 17in., 1,506 r.p.m.

CINCINNATI No. 2 Dial Type Universal Miller, table 49in. × 10in. capacity, 28in. × 10in. × 16in.

BROWN & SHARPE 2A Universal Miller, table 45in. × 10in.; capacity 28in. × 10in. × 18in.

PLANING MACHINES

BUTLER 36in. Openside Crank Planers, with side head, table 48in. × 23in.; admit 24in. under cross slide; 4 to 40 strokes per minute.

SAWING MACHINES

TAYLOR No. 1 Cutting Off Machine, for 4in. tubes: 1½in. bars.

NEW **KALTENBACH** Model HDM750 Hydraulic Circular Sawing Machines, 30in. dia blade to cut 9in. dia. bar, 16in. × 6in. R.S.J SOLE BRITISH AGENTS.

NEW **KALTENBACH** 14in. Blade Model KKS 350 Universal Circular Sawing Machine to cut steel and non-ferrous metals any angle from 0 deg. to 180 deg. Send for particulars of this unusually versatile machine. Demonstrations gladly arranged. SOLE BRITISH AGENTS.

TAYLOR No. 1142 high speed Circular Saw for ⅜ in. bars, 1½in. table.

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Telephone: EUSton 5000 Telex No. 24264
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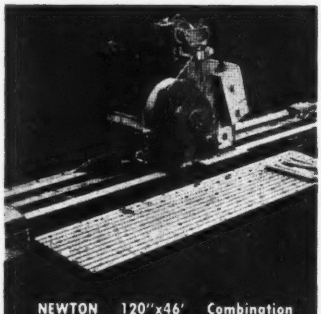
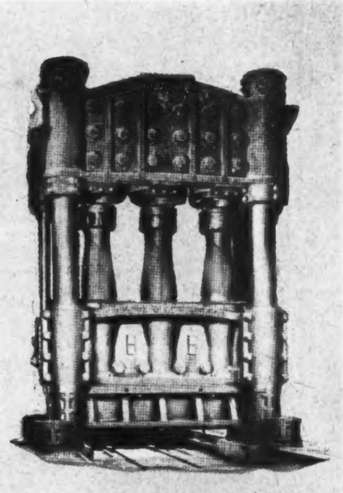
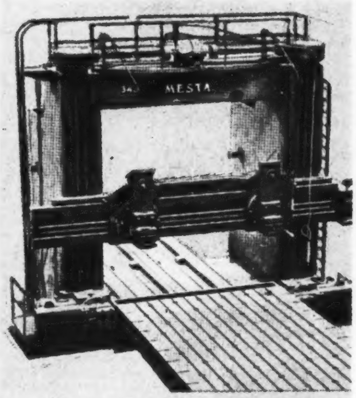


NEWTON 120"x46' Combination Rotary Planer & Cold Saw.



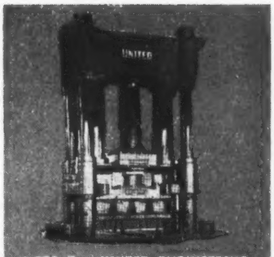
14,000 Ton MESTA PRESS 3 cyl. Water, 18' Daylight, Dist. Bet. Cols. 19'x8'6", Stroke 7'6", 6300 PSI Hydro-Pneumatic Operation Transf., Starting Equip., & all Misc. Aux. Equip.



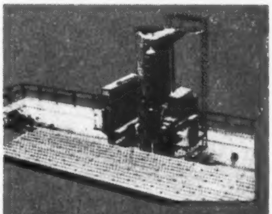
MESTA PLANER 14½'x14'x42'. Four Heads, 150 HP Variable Voltage Drive.

NILES PLANER 15'x14'x36', Four Heads, 150 HP Variable Voltage Drive.

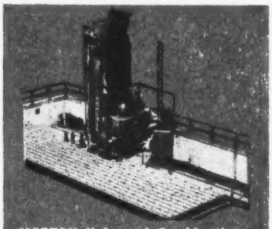
6,500 Ton MESTA PRESS Down Moving Hydraulic Bending, 4 Rod Type, with Self Contained Pumping Units, Bed arranged with hydraulic front to rear travel to facilitate loading and unloading if desired. Bed 15'x15', ram 7'16"x 16' stroke 60", daylight 84", diam. of rods 24".
3,000 Ton BLISS Hydraulic PRESS. CLEARING Model H-3000-60, 18" Stroke, Bed 60"x7'4", 1952.
No. 1301-5 BLISS Brass & Alum. Slab SHEAR. Line Capacity 2¼"x20", 2"x 24" Brass with Pack Storage Conveyor. New 1952, Never Used.



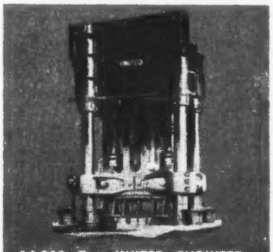
6,500 Ton UNITED ENGINEERING Water PRESS, Stroke 10', Daylight 19'4", Dist. Bet. Cols. 18'5"x7'4", 4500 PSI Hydro-Pneumatic Accumulator System with Pumps, Pressure Vessels, Transf. Starting Equip. & all Misc. Aux. Equip.



INGERSOLL 12'x46' Universal Traveling Housing Type Boring & Milling Machine.



MORTON Universal Combination, Boring, Drilling, Milling Machine and Draw Cut Planer. 12'x42', 10¾" Spindle.



14,000 Ton UNITED ENGINEERING PRESS, 4 col., 2 Ram Type Water, Stroke 10', Dist. Bet. Cols. 23'x11'6", Daylight 22' 4500 PSI Hydro-Pneumatic Accumulator Syst. with Pumps Pressure Vessels, Transf., Starting Equip. Misc. Aux. Equip.

Classified Advertisements (*PLANT FOR SALE, contd.*)

WIDDOWSONS

LANG 8½in. S.S. & S.C. Centre Lathe, 5ft between centres, with taper turning attachment, spindle speeds 19 to 900.

ALFRED HERBERT No. 9a Heavy Duty Combination Turret Lathe, 20½in. swing over bed, with taper turning attachment, spindle speeds 11 to 809 r.p.m., covered bed, well equipped.

OLDFIELD & SCHOFIELD 32in. Swing Gap Bed S.S. & S.C. Lathe, 10ft. between centres, swing in gap 50in. × 16in. Taper turning attachment.

PEARN-RICHARDS PRT2N Horizontal Boring and Facing Machine, 3in. dia. traversing spindle, chain drive to head, 400/3/50.

PENSOTTI Model KTV1050 Turret Type Single Column Vertical Boring and Turning Mill, with sidehead. To swing 43in. dia., admit 32in. under cross slides, 20 h.p. motor.

MITCHELL 8½in. Centres Gap Bed S.S. & S.C. Lathe. Several available. All As New. 52in., 54in., and 64in. between centres.

WARD No. 13 Combination Turret Lathe, covered bed, 25in. concentric chuck, 27in. 4-jaw independent chuck. Good turret tooling, taper turning attachment, 35 h.p. motor, 400/3/50. Modern machine. Excellent equipment.

DEMM Model S 18-750 Gear Shaping Machine.

REINECKER Model SSM3 10ft. Heavy Duty External and Internal Spur Gear Shaping Machine. 6¾in face width.

JONES & SHIPMAN Model 921 Heavy Duty Pillar Drilling and Tapping Machine. No. 5 M.T.

ORMEROD 20in. Stroke Pedestal Type Shaping Machine, 9 speeds 9 to 104 s.p.m., 5 h.p. motor. Two machines available.

KAESER (Swiss) Hydraulic Plain Cylindrical. Grinding Machine. Two machines available. Capacity 6in. × 36in. and 10in. × 20in. Both in excellent condition.

CHURCHILL Model VB Slideway Grinding Machine, 72in. × 34in. × 36in. Excellent condition.

CINCINNATI Model 4HP Heavy Duty Vertical Milling Machine. Table 72in. × 19in., speeds 17 to 480 r.p.m.

CINCINNATI Hydromatic 56-72 Hydraulic Plain Horizontal Production Milling Machine. table 103in. × 26in., speeds 24 to 179 r.p.m.

MASSEY 2-cwt. Pneumatic Power Hammers, 14in. stroke, 200 blows per minutes, 10 h.p. motor.

HERBERT

WIDDOWSON

& SONS LTD.

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FLAME HARDENING EQUIPMENT

I.C.I. Cyanide Furnace 15in. × 36in. with 2 spare pots.

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Quantity of Heat Treatment Salts.

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CINCINNATI Hydraulic milling Die-sinking and Slotting Machine. Left and right hand copying from one Master, with extra accessories and attachments. Electric A.C. 3 phase, 400 low volt lighting. As new. A bargain. £1,850.

"CHURCHILL" CENTRE LATHE 6½in. swing over bed, 2ft. between centres, Gap Bed, Taper turning. Fully enclosed geared head and with dial selection of Feeds T.P.I. and Speeds. 32 to 1,000 R.P.M. Forward and reverse. On pedestal cabinet with drawers and lockers, complete with faceplate, driving plate, centres and 3 Jaw chuck. A.C. 400 v., 3 phase motor and switchgear integral with machine. Condition perfect. Price £450

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Richmond HB3/12 Radial Drill, 3ft. 6in. arm, box table, coolant, etc. recently purchased new. Bargain at £1,100.—BOX D370, MACHINERY, Clifton House, Euston Road, N.W.1.

One Zephair Solid Fuel Space Heater, rating 500,000 BTU per hour, Burner motor 1/3 h.p. × 240 volts, fan motor 2 h.p. × 440 volts.—Battersea 8822, Ext. 253.

Kircheis Double Sided Double Crank Geared Power Press for sale, Pressure about 80 tons. Stroke 2⅜in. Between side frames 34in. Bed 32in. × 32in. Hole in bed 21½in. × 13in. Ram face 26⅜in. × 29½in. Arranged motor drive 400-440/3/50. Automatic safety guard.—F. J. EDWARDS LIMITED, 359, Euston Road, N.W.1, or 41, Water Street, Birmingham 3.

Magnetic Separator for Ferrous materials. Postable machine. Hopper feed. Twin drums. Motorised.—WILCOX & CO., Barr Street, Birmingham 19. Northern 1234-5.

No. 4 Kearns Patent Horiz. Boring and Facing Machine, with 4in. dia trav. spindle. Automatic facing, 54in. dia Main table 66in. × 42in. Top table 48in. × 48in. Balanced head.—LEE & HUNT, LTD., Crocus Street, Nottingham. 'Phone 84246.

Kitchen & Wade G.5 5ft. Girder Radial Drilling Machine in new condition. 3 Speeds and 3 Feeds. Further details from:

C. & G. OLDFIELD, LIMITED,
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Newman

AUTOMATICS

CONOMATIC 3½in., 4-spindle Bar Auto.
BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle.

BORING MACHINES

WETZEL Horizontal traversing column Floor, Boring and Facing Machine, 7in. diameter travelling spindle, 45in. diameter facing head. (Two available.)
KEARNS Model OC Horizontal Boring Machine, 3in. dia. travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3½in. travelling spindle, 28in. diameter facing head.

CAPSTAN AND CENTRE LATHES

CHURCHILL-REDMAN Model 13NM Heavy Duty S.S. & S.C. Gap Bed Centre Lathe, 13in. centre height × 72in. between centres. Swing in gap 50in.
OLDFIELD & SCHOFIELD Surfacing and Boring Lathe, 10½in. centre height.
WARD 7B Combination Turret Lathe.
NILES Heavy Duty Centre Lathe, S.S. & S.C. 17in. centre height × 28ft. between centres.

DRILLING MACHINES

ASQUITH Model OD.1 5ft. Elevating Arm Radial Drilling Machine.
HETTNER Radial Drilling Machine, 10ft. elevating arm.

GEAR MACHINES

ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

NEWALL Type LA Plain Hydraulic Cylindrical Grinding Machine, 10in. × 36in. (Two available.)
CHURCHILL Model HBY Internal Grinding Machine.
CHURCHILL Plain Cylindrical Grinding Machine, 26in. swing × 84in. between centres (1951).
LANDIS Type C Plain Hydraulic Cylindrical Grinding Machine, 6in. swing × 18in. between centres.
ORCUTT Model HM24 Internal Spur Gear Grinding Machines.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing × 54in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing × 36in. between centres

MILLING MACHINES

CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 91in. × 22in. (1952).
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. × 10in.
PRATT & WHITNEY Model BL3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. × 16in.

MISCELLANEOUS

LANGE & GAILEN 28in. stroke Double Headed Hydraulic Shaping Machine.
TAYLOR & CHALLEN Double Sided 50-ton Geared Power Press, 10in. stroke.

NEWMAN INDUSTRIES LIMITED

Machine Tool Division: YATE, BRISTOL

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—▶ **CONOMATIC** (U.S.A. Built) 4 Sp. 4⅜in. Cap.
GREENLEE 6 Sp. 1⅝in. Cap.
—▶ **CONOMATIC** 6 Sp. 1¼in. Cap.
—▶ **B.S.A. GRIDLEY** 6 Sp. 1in. Cap. Bar (1952).
B.S.A. GRIDLEY 4 sp. 7in. Cap.
GRIDLEY 6 Sp. $\frac{7}{16}$in. Cap. (Choice of two).
—▶ **B.S.A.** No. 68 Single Spindle ⅝in. Cap. (Choice of two.)
B.S.A. No. 38 Single Spindle ½in. Cap.
HERBERT No. 4 Chucking.

BORERS

Horizontal
PEARN RICHARDS No. 3 with 24in. dia. facing head. Table Area 7ft. 3in. × 5ft.
—▶ **RICHARDS** HB. 2A 3in. Travelling Spindle (Choice of three).
—▶ **KEARNS** OC. 2¾in. Travelling Spindle (Choice of three).

Vertical
CRAVEN 36in. heavy duty, side head, elevating cross rail, rapid feeds.

GRINDERS

—▶ **CHURCHILL** 20in. × 96in. Hyd. Cylindrical. S/N20468.
—▶ **LANDIS** 6in. × 18in. Hyd. Plain Cylindrical P.F. (1952).
CHURCHILL 16in. × 72in. Universal.
CHURCHILL 12in. × 50in. Hyd. Universal, internal spindle.
FITCHBURG 12in. × 32in. Universal.
JONES & SHIPMAN 8in. × 16in. Universal, internal spindle.
HEALD 72A3 Internal Grinders, Series 18,000 (Choice of two).
—▶ **LUMSDEN** 24in. dia. Retractable Rotary Table Surface Model 90RT. With Chuck (1952).
ORCUTT 20in. Spline.

GEAR MACHINERY

—▶ **GLEASON** No. 24 Straight Bevel Generator S/N17920.
—▶ **GLEASON** 12in. Bevel Gear Generator, roughing and finishing, single roll type. S/N20129.
MICHIGAN Gear Lapper. S/N2280.

DRILLS

Radial
ARCHDALE 4ft. 0in.; 60 to 1,500 r.p.m. (Choice of four).
KITCHEN & WADE 4ft. 0in. Bridge Type.

Single Spindle
—▶ **ASQUITH** Type U.G.D. 2in. Cap.; 31/850 r.p.m. Column (Choice of two). 1952.
POLLARD CORONA $\frac{7}{16}$in. cap. 642-12,040 r.p.m. bench. (Selection of several.)

Multi Spindle
—▶ **BARNESDRILL** Hyd. Type H.4 16 Sp. ⅞in. Cap.
—▶ **ARCHDALE** Cluster 12 Sp. ⅜in. Cap.
ARCHDALE 4 Sp. Power down feed to 2 Sp. Speeds 445-1,445 table 49in. × 16in.
ARCHDALE 4 Sp. Power down feed to 1 Sp. Speeds 445-1,445, table 49in. × 16in.
POLLARD Corona Model H.E.F., 4 Spindle, $\frac{7}{16}$in. Cap. 642-12,040 r.p.m. Bench. (Choice of two.)

MILLING MACHINES

Plano
—▶ **KENDALL & GENT,** table 5ft. × 4ft. × 4ft. 6in.
—▶ **KENDALL & GENT,** table 5ft. × 4ft. × 3ft. 6in.

Duplex
—▶ **CINCINNATI** Type 56-72 Hydromatic with Automatic variable feed unit. Table 8ft. 6in. × 2ft. Speeds (forward and reverse) 82-623 r.p.m.

Vertical
—▶ **HERBERT** 28V, table 85in. × 28in.; 12 to 360 r.p.m.
—▶ **HERBERT** 47. Table 72in. × 17in.; 21 to 750 r.p.m.
CINCINNATI 4 HP, table 78½in. × 16¼in.; 17 to 480 r.p.m. (Choice of two.)
—▶ **CINCINNATI** No. 4 Dial type, table 78½in. × 16¼in., 18 to 450 r.p.m. Power down feed.
—▶ **CINCINNATI** No. 3 Dial Type, table 62½in. × 15¼in.; 18 to 450 r.p.m. (Choice of three.)
—▶ **CINCINNATI** No. 2 Dial type, table 52½in. × 12½in.; 20 to 500 r.p.m.
ARCHDALE 18in., table 38in. × 10in.; 79 to 2,000 r.p.m.

Plain Horizontal
—▶ **MILWAUKEE** 2K, 15 to 1,500 r.p.m. (Rebuilt). (Choice of two.)
ARCHDALE 20in., table 40in. × 10in.; 60 to 1,230 r.p.m. Rapid Production.
CINCINNATI 2/24 Production.
CINCINNATI O8, table 18½in. × 6¾in.; 75 to 1,100 r.p.m. Production. (Choice of two.)

LATHES

Centre
SWIFT 13in. × 132in.; 3.6 to 220 r.p.m. Straight Bed.
SPRINGFIELD 12in. × 48in.; 9 to 380 r.p.m. Straight Bed.
—▶ **SCULFORT** 12in. × 70in.; 12.5 to 1,000 r.p.m. 1952.
DEAN, SMITH & GRACE 12in. × 66in., 19 to 418 r.p.m. Straight Bed.
PROGRESSIVE 11in. × 120in.; 20 to 516 r.p.m. Gap Bed.
SWIFT 10½in. × 96in.; 11 to 400 r.p.m. Straight Bed.
MONARCH 20in. swing, 96in. B.C. 12 to 487 r.p.m. Straight Bed.
DEAN, SMITH & GRACE 8½in. × 50in.; 11 to 490 r.p.m. Straight Bed.
DEMOOR 8½in. × 84in.; 25-1,250 r.p.m. Gap Bed.
HOLBROOK 8½in. × 42in.; Straight Bed (Choice of two).
PROGRESS 8in. × 60in.; 23 to 1,050 r.p.m. Gap Bed.

Capstan, Comb. Turret
LIBBY IH5 Comb. Hole in spindle 5½in. Power and rapid feeds to Saddle, Turret and Cross slide.
—▶ **GISHOLT** 2L Comb. 22in. swing. 1952 built.
HERBERT 21 Comb. No cross slide.
WARD 10B Comb. Power feed to Turret, Air Ball Chuck, Bar Feed Equipment Rebuilt.

VARIOUS

BARNESDRILL 6in. × 45in. Vertical Honer.
BARNESDRILL 5in. × 25in. Vertical Honer.
—▶ **RHODES** 75 ton Double Sided Single Geared Press, fitted with Worsam air cushion.
BUTLER 24in. Heavy Duty Production Type Slotter.
BUTLER 12in. Stroke Slotter with tilting table.
BUTLER 18in. Stroke Super Shaping Machine.

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Series 98, 90/135 tons, 8ft. by $\frac{3}{16}$in.
Series 68, 60/90 tons, 8ft. by 10G
Series 48, 40/60 tons, 8ft. by 14G

OTHER NEW MACHINES FROM STOCK

HEINEMANN 28in. Stroke, Heavy-duty, High-Speed, Hydraulic Shaper with power down feed.
DENBIGH D.4 Mill, Table 46in. by 10in.; 22-720 r.p.m.

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BOLEY & LEINEN S.R.26 High Speed Multi Tool Turret Lathe. 1in. Capacity 42/2,400 r.p.m.
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LANG 10in. by 60in. S.S. & S.C. Lathe. 10-500 r.p.m. Spindle Bore 2½in. 12½ h.p.
COLCHESTER Master 6½in. by 36in. Centre Lathe, Gap Bed, Ainjest Screwing, 57-1,000 r.p.m.
SWIFT Profile Copy Lathe. 18in. by 5ft. 6in. Speed Range 10-600 r.p.m. Excellent Condition.
PRATT & WHITNEY 12B Profile Mill. Twin Spindles. 225-2,880 r.p.m
CINCINNATI No. 4 Dial Type Horizontal Milling Machine. Speed Range 18-1,300 r.p.m. Rebuilt 1961.
CINCINNATI No. 3 Dial Type Horizontal Milling Machine. Speeds 18-450 r.p.m.
EDGWICK Horizontal and Vertical Mill 11in. by 46in. Table. 24-405 r.p.m. Horizontal. Vertical Milling attachment 42-680 r.p.m.
VICTORIA U.2 Rapidmil with Vertical Milling Attachment, 48in. by 11⅞in. table, 30-1,050 r.p.m.
CINCINNATI 1-18 Production Mill.
KENDALL & GENT Vertical Mill. Table 19in. by 69in. Speed Range 20-300 r.p.m.
INVICTA 5M Shaper. 21in. Stroke. 6 Speeds. Good Condition.
BUTLER 14in. Slotter. 6 Speeds 4in. to 14in. Stroke. Table Diameter 39in. 12½ h.p.
DOWDING V 8 Gear Hobber. Capacity 8in. dia. Maximum Pitch Hobbed in one cut 14 d.p. Hob Traverse 7¼in. 6-400 Teeth. Fully equipped.
MATHEY Jig Borer. Table 34in. by 12in. Speeds 80-1,680 r.p.m.
CHURCHILL "HBA" Automatic Internal Grinder. Table Traverse 18in. Maximum Swing over Table 19in. Work Speeds 48-340 r.p.m.
MAGERLE F.10 Surface Grinder. 41in. by 9in. Table. Automatic Feeds. Infinitely variable on all traverses.
BROWN & SHARPE No. 13 Universal Grinder. Capacity 8in. dia. 27in. between centres.
EXCEL No. 1 Pedestal Model Surface Grinder.

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Potter & Johnson 4D Chucking Auto complete with all Tooling. Two Machines available. Further details from:
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Springfield 7in. × 36in. Turret Lathe—speeds 11 to 398—equipped.—C. DUGARD, LTD., Denmark Villas, Hove 32471.

Olivetti Kneeless Auto-cycle Production Miller, 27in. traverse, 44in. × 12in. table, speeds 30-375. Used for demonstration only. Perfect.—C. L. THOMAS, LTD., Stirling Road, Solihull. Tel.: 3075-6.

SNOW Horizontal Spindle Surface Grinder, hydraulic. Motor drive 400/440 volts, 3 phase, 50 cycles. Table working surface 24in. by 8in.
DISKUS Vertical Spindle Surface Grinder, hydraulic. Motor drive 380 volts, 3 phase, 50 cycles. Table working surface 32in. by 10in. Segmental grinding wheel 14in. diameter.
CHURCHILL Horizontal Spindle Surface Grinder. Motor drive 400 volts, 3 phase, 50 cycles. Table working surface 36in. by 12in

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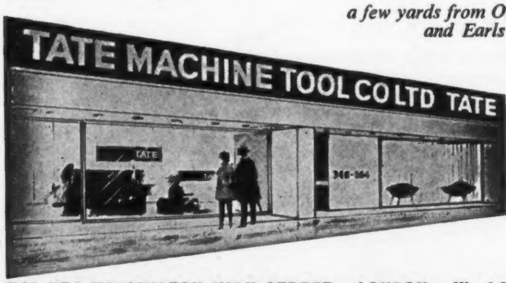

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PRATT 3ft. 6in. × 16 gauge U/Crank Power Guillotine.

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HERBERT No. 4 Capstan Lathe. 2½in. hollow spindle. Speeds to 511.
HERBERT 7 Junior Comb. Turret, 2in. hollow spindle. Speeds to 767 r.p.m.
HERBERT 9 Comb. Turret. Hollow spindle. Speeds to 400 r.p.m.
HERBERT Carbicut Lathe. Speeds to 3,025 r.p.m.

MILLING MACHINE

MILWAUKEE 3H Horizontal Miller. Speeds 1,000 Table 63in. × 13½in.

NIBBLERS

W.F. 14 Gauge Nibbler. 59in. throat.
BURFREE 2A Nibbling Machine. Cap. ⅜in. M/S.

POLISHING SPINDLES

CANNING 5 h.p. Double Ended Polishing Spindles.

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BRADLEY & TURTON No. 3 Flypress.
NORTON No. 4 Flypress.
TAYLOR & CHALLEN 1274 Notching Press.
TAYLOR & CHALLEN B2 10 Ton O/F Power Press.
TAYLOR & CHALLEN 370 20 Ton O/F Power Press.
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NEW **RAPIDOR** 6in. Power Hacksaw.
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Classified Advertisements (*PLANT FOR SALE, contd.*)

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Qualifications H.N.C.

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Small advertisements telephoned Wednesday, will be inserted the following Wednesday.

FOR "CLASSIFIED" ADVERTISEMENT RATES PLEASE SEE PAGE 179. SERIES RATES ON REQUEST.

SITUATIONS WANTED

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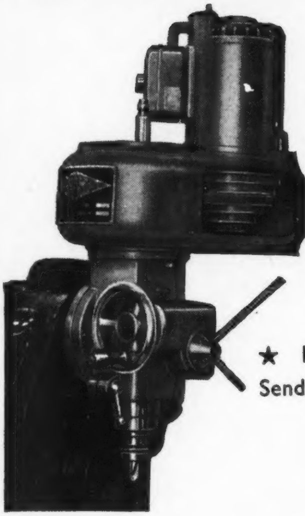

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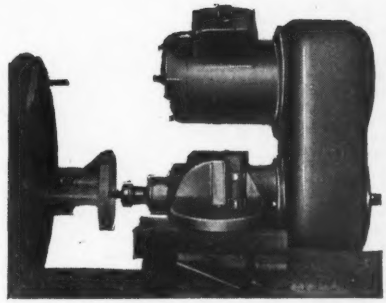

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INDEX TO ADVERTISERS *(Continued from page 213)*

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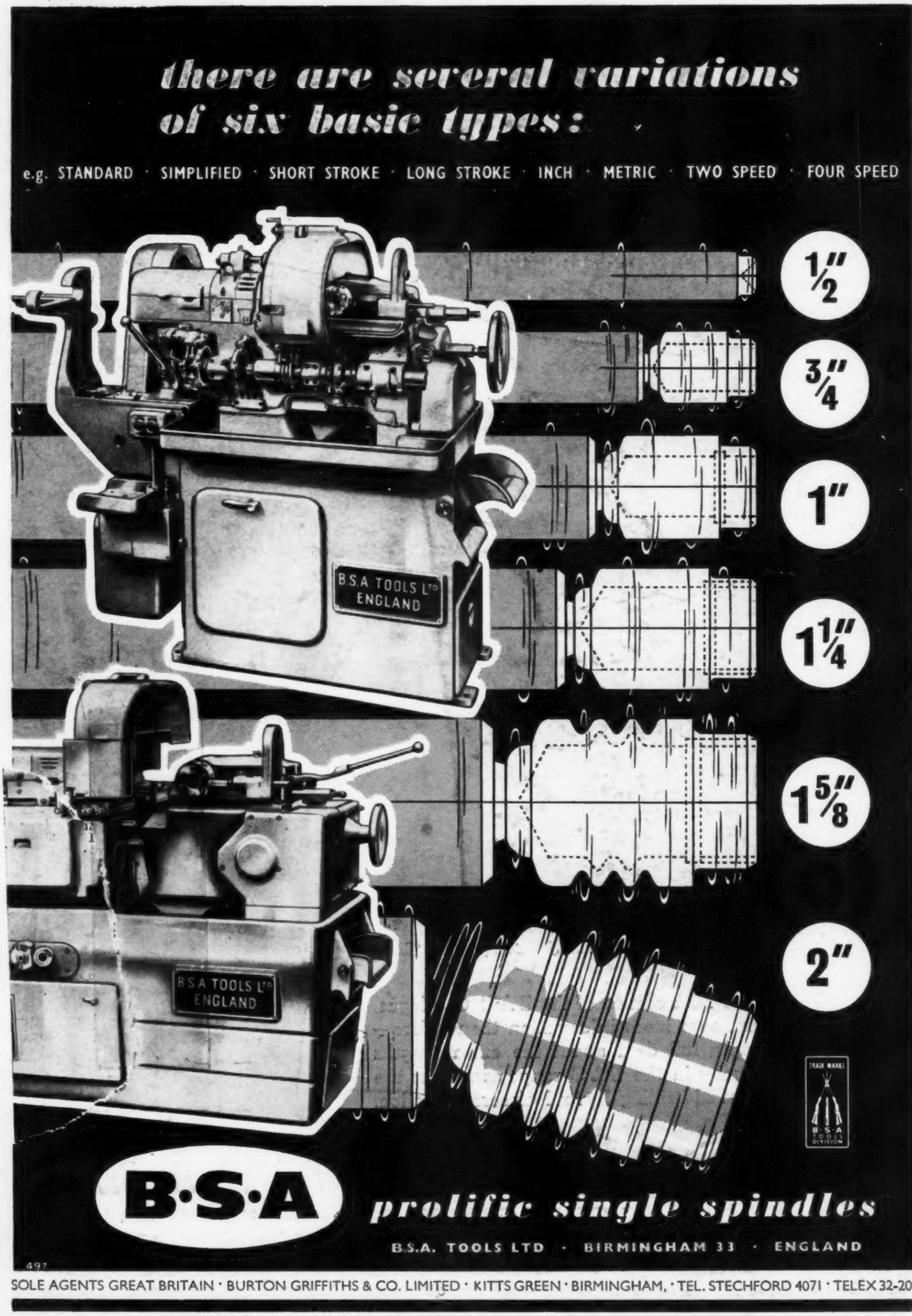

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